LONGMANS' PRACTICAL ARITHMETICS

PUPILS' SERIES

BOOK 4.

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WITH MESSRS.
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COMPLIMENTS.

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LONGMANS, GREEN & CO.
39 PATERNOSTER ROW, LONDON,
NEW YORK, BOMBAY & CALCUTTA.

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TABLES, ETC.

MONEY.

4 farthings = 1 penny.
12 pence = 1 shilling.
20 shillings = 1 pound.

NUMBER.

1 dozen = 12.
1 score = 20.
1 gross = 144.

PARTS OF £1.

£$\frac{1}{2}$ = £0·5 = 10/-
£$\frac{1}{4}$ = £0·25 = 5/-
£$\frac{3}{4}$ = £0·75 = 15/-
£$\frac{1}{8}$ = £0·125 = 2/6.
£$\frac{3}{8}$ = £0·375 = 7/6.
£$\frac{5}{8}$ = £0·625 = 12/6.
£$\frac{7}{8}$ = £0·875 = 17/6.

PARTS OF 1/-

$\frac{1}{2}$ of 1/- = 0·5 of 1/- = 6*d*.
$\frac{1}{4}$ of 1/- = 0·25 of 1/- = 3*d*.
$\frac{3}{4}$ of 1/- = 0·75 of 1/- = 9*d*.
$\frac{1}{8}$ of 1/- = 0·125 of 1/- = $1\frac{1}{2}$*d*.

2/- = £0·1.
1/- = £0·05.
6*d*. = £0·025.

TIME.

60 seconds = 1 minute.
60 minutes = 1 hour.
24 hours = 1 day.
7 days = 1 week.
4 weeks = 1 lunar month.
52 weeks = 1 year.
365 days = 1 year.
366 days = 1 leap year.

CAPACITY.

2 pints = 1 quart.
4 quarts = 1 gallon.
2 gallons = 1 peck.
4 pecks = 1 bushel.

1 bushel = 4 pecks
= 8 gallons.

1 gallon = 4 quarts
= 8 pints.

WEIGHT.

16 ounces (oz.) = 1 pound (lb.).
28 pounds = 1 quarter (qr.).
4 quarters = 1 hundredweight (cwt.).
20 hundredweights = 1 ton.

14 pounds = 1 stone (st.).
2 stones = 1 quarter.
8 stones = 1 hundredweight.
112 pounds = 1 hundredweight.

LONGMANS' PRACTICAL ARITHMETICS

PUPILS' SERIES. BOOK IV

A COURSE OF ARITHMETIC CORRELATED WITH GEOMETRY AND PRACTICAL WORK, BASED ON THE SCHEME OF C. T. MILLIS, M.I.MECH.E., PRINCIPAL OF THE BOROUGH POLYTECHNIC INSTITUTE

HIGHER SECONDARY SCHOOL BANGALORE-1. A.L.A.N.M.S.

BY

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H. E. HOWARD

HEAD MASTER, ST. LUKE'S SCHOOL, KINGSTON-ON-THAMES

NEW EDITION

WITH MESSRS. LONGMANS, GREEN & CO.'S COMPLIMENTS.

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1909

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LONGMANS' PRACTICAL ARITHMETICS

BOOKS FOR TEACHERS AND PUPILS

PUPILS' BOOKS

JUNIOR

Book I.—For pupils from 7 to 9 years of age.

Book II.—For pupils from 8 to 10 years of age.

INTERMEDIATE

Book III.—For pupils from 9 to 12 years of age.

Book IV.—For pupils from 10 to 13 years of age.

NOTE.—The above books are arranged on a concentric plan, and each of them is divided into three distinct parts. Each part is complete in itself, and provides work for a definite "period" of time, the length of which will depend upon the circumstances of the school. Thus the four books may provide a course for 4, 5, or 6 years of school life.

SENIOR

Book V.—For pupils from 11 to 14 years of age.

Book VI.—For pupils from 12 to 15 years of age.

Book VII.—For pupils from 13 to 15 years of age.

TEACHERS' BOOKS

A series of seven books corresponding with the above, and containing—

(*a*) Suggestions to teachers in regard to arrangement of work and methods of teaching.

(*b*) Detailed treatment of the geometrical and practical portions of the syllabuses.

(*c*) Full notes of typical lessons.

(*d*) Illustrative examples worked out.

(*e*) Additional exercises and problems.

(*f*) Answers to the exercises in the Pupils' Books.

BANGALORE-1.

LONGMANS' PRACTICAL ARITHMETICS

PUPILS' BOOK—IV
(INTERMEDIATE)

PART I

EXAMPLES 1 (a).

(1) Write, in words, **3620**, **5015**, and **6109**.

(2) Write, in figures—

Six thousand four hundred and fifty-six.
Three thousand and twenty-nine.
Two thousand one hundred and forty.

(3) **5** thousands + **2** hundreds + **3** tens + **6** units = **x**. Write down the value of **x**.

(4) **3208** = **p** thousands + **q** hundreds + **r** tens + **s** units. Instead of the letters **p**, **q**, **r**, and **s**, write down the proper numbers.

(5) Multiply **634** by **10**, **86** by **100**, and **9** by **1000**.

(6) Divide **7580** by **10**, **6900** by **100**, and **4000** by **1000**.

(7) How many metres are there in **7** kilometres? In **9** hectometres? In **5** decametres?

(8) Express **6530** metres as decametres, **8200** metres as hectometres, and **7000** metres as kilometres.

EXAMPLES 1 (b).

(1) Write in figures in two different ways—
6 thousandths, **52** thousandths, and **345** thousandths.

(2) Write in words—

(*a*) $\frac{6}{1000}$, $\frac{54}{1000}$, $\frac{137}{1000}$.

(*b*) ·009, ·015, ·508.

(3) Write as decimals—

$\frac{678}{1000}$, $\frac{86}{1000}$, $\frac{9}{1000}$, $\frac{205}{1000}$.

(4) Add together—

$\frac{8}{1000}$, $\frac{57}{1000}$, and $\frac{130}{1000}$, and write the answer as a decimal.

(5) 2·345 = a units + b tenths + c hundredths + d thousandths. What are the values of a, b, c, and d?

(6) Take $\frac{18}{1000}$ from $\frac{104}{1000}$, and write the answer as a decimal.

(7) Multiply 5·46 by 10; 3·25 by 100; and 7·68 by 1000.

(8) Divide 15·3 by 10; 16·8 by 100; and 24·6 by 1000.

EXAMPLES 1 (c).

(1) How many decimetres are there in
8, 7·5, 0·6, 3·4, and 96 metres?

(2) How many centimetres are equal to
6, 58, 4·3, 0·7, and 0·08 metres?

(3) Express as millimetres—
9, 5·8, 0·7, 0·63, 0·08 metres.

(4) Express as metres—
(*a*) 536, 95, 7, 6·5, 0·8 decimetres.
(*b*) 752, 89, 5, 3·6, 0·7 centimetres.
(*c*) 5234, 687, 49, 8, 6·5 millimetres.

(5) Express as metres—
(*a*) 65, 9, 3·5, 0·6, 0·07 decametres.
(*b*) 96, 5, 4·7, 0·8, 0·05 hectometres.
(*c*) 52, 3, 2·8, 0·6, 0·07 kilometres.

(6) Write down 6·5 metres as decametres; 7·3 metres as hectometres; and 4·5 metres as kilometres.

(7) 3245 metres = p kilometres + q hectometres + r decametres + s metres. Write down the values of p, q, r, and s.

(8) 4·685 metres = a metres + b decimetres + c centimetres + d millimetres. What are the values of a, b, c, and d?

EXAMPLES 2 (a). (Revision.)

(1) Find in two different ways the value of
$(56 \times 37) + (84 \times 37)$.

(2) If $x = 64$, find the value of—
(i.) $136 + x + 47$; (ii.) $136 - x + 47$; (iii.) $25x$.

(3) When $x = 42$, find the value of—
(i.) $(x + 86) - 59$. (ii.) $(x + 86) \times 37$.
(iii.) $(x - 16) + 95$. (iv.) $(x - 16) \times 59$.

(4) Find the value of $(137 \times x) - (46 \times x)$, when $x = 38$.

(5) A man divided 348 marbles between two boys, giving one of them 68 more than the other. How many marbles did each boy receive?

(6) 28 rolls of cloth each measuring 36 yards in length were used in making dresses which required 7 yards each. How many dresses were made?

(7) A greengrocer bought 8 boxes of oranges, each containing 125. Of these, 55 were bad. The remainder were sold in equal numbers to 27 people. How many did each person buy?

(8) If 864 nuts were divided among 12 boys and 12 girls, so that each girl received twice as many as each boy, how many nuts did each boy get?

EXAMPLES 2 (b).

(1) In a brigade there were three regiments, numbering 1368, 905, and 1427 men respectively. How many men were in the brigade?

(2) If $8016 - 728 = x$, what is the value of x?

(3) A certain ship started from **A** with a load of **7325** tons. At **B** it discharged **3070** tons of cargo, and at **C** it took in **4208** tons. It then went to **D**, and there discharged the whole of its cargo. How many tons were discharged at **D**?

(4) From the sum of **2016**, **948**, and **3502** take **2065**.

(5) When $x = 237$, find the value of $16x$.

(6) The distance between two railway stations is **148** miles. How many miles would an engine travel in covering this distance **26** times?

(7) Find the value of x, when $9x = 3744$.

(8) Six times a certain number is **5322**. What is the number?

EXAMPLES 2 (c).

Work these division sums, and prove the answers by multiplication—

(1) **864** lbs. ÷ **24**, **36**
(2) **1036** lbs. ÷ **28**, **37**
(3) **1363** tons ÷ **29**, **47**
(4) **1748** yards ÷ **38**, **46**
(5) **1875** miles ÷ **25**, **75**
(6) **2585** metres ÷ **47**, **55**
(7) **2592** feet ÷ **48**, **54**
(8) **3045** cwts. ÷ **35**, **87**
(9) **4284** galls. ÷ **63**, **68**
(10) **5292** yards ÷ **54**, **98**
(11) **5762** cms. ÷ **67**, **86**
(12) **5980** cms. ÷ **65**, **92**

EXAMPLES 2 (d).

Work these division sums, giving the answers to the first decimal place—

(1) **378** lbs. ÷ **28**
(2) **567** lbs. ÷ **35**
(3) **629** lbs. ÷ **34**
(4) **732** galls. ÷ **46**
(5) **714** galls. ÷ **54**
(6) **836** galls. ÷ **35**
(7) **862** tons ÷ **49**
(8) **896** tons ÷ **58**
(9) **916** tons ÷ **52**
(10) **953** metres ÷ **67**
(11) **1014** metres ÷ **74**
(12) **1235** metres ÷ **83**

EXAMPLES 2 (e).

(1) Divide **2142** nuts equally among **34** boys. How many nuts will each boy receive?

(2) Two numbers multiplied together are equal to **2408**. One of the numbers is **43**. What is the other?

(3) If a ball of string measures **540** inches in length, how many pieces of string, each **36** inches long, can be cut from it?

(4) If a ball of string, measuring **539** inches long, is cut into **35** equal pieces, how long is each piece?

(5) The sum of **£540** is shared equally among **25** men. How much does each man receive? (Give the answer in pounds.)

(6) The wages of a certain number of men amounted to **£338**. Each man received **£26**. How many men were there?

(7) In **29** innings a cricketer made altogether **1213** runs. What was his average number of runs per innings?

(8) In walking a distance of **187** feet, a boy took **68** steps. What was the average length of his steps? (Answer to the second decimal place.)

EXAMPLES 3 (a).

(1) Find the sum of 4·08 tons, 37·025 tons, 332·5 tons, and 6·037 tons.

(2) From £7·015 take £3·209.

(3) A certain German coin is worth £0·984. What is the difference between its value and the value of 1 English sovereign?

(4) One vessel contains 7·5 gallons and another 3·48 gallons. How much is contained in the two vessels together, and how much more is there in the one than in the other?

(5) The following distances are measured along a straight road. From A to B, 3·15 kilometres; from B to C, 4·275 kilometres; from C to D, 9·138 kilometres; and from D to E, 6·19 kilometres. What is the distance in kilometres from A to E?

(6) Three articles are sold for £6·05, £2·315, and £3·274 respectively. What was the selling price of the three together?

(7) The three sides of a triangle measure 6·35 inches, 4·27 inches, and 3·59 inches. Find the difference between the length of the longest side and the sum of the lengths of the other two sides.

(8) One engine weighs 56·345 tons and another 47·269 tons. What is the difference between their weights?

EXAMPLES 3 (b).

(1) Find the area of a rectangle, whose length is 6·25 inches and breadth 3·7 inches.

(2) Find to the nearest square inch the area of a sheet of paper 12·6 inches long and 9·8 inches wide.

(3) If a metre is equal to 1·09 yards, how many yards are equal to 7·5 metres?

(4) A certain French measure (a Litre) is equal to 1·76 pints. How many pints are equal to 4·3 litres?

(5) Draw a rectangle 5 inches long and 3·7 inches wide. Measure its sides in centimetres and find its area in square centimetres, as accurately as you can.

(6) Find the cost of 3·65 tons at £1·4 per ton.

(7) A train is travelling at the rate of 32·8 miles per hour. How far will it travel in 6·5 hours at this rate?

(8) A parcel weighs 1·68 pounds. What is the weight in pounds of 47 such parcels?

EXAMPLES 3 (c).

Work these division sums. The answers need not be given to more than three decimal places:—

(1) 59·076 tons ÷ 6
(2) 121 inches ÷ 8
(3) 75·3 metres ÷ 7
(4) 78·1 cwts. ÷ 25
(5) 3·375 yards ÷ 27
(6) 4·35 miles ÷ 28
(7) 32·5 feet ÷ 26
(8) 127·65 pounds ÷ 37
(9) 540·08 kilometres ÷ 43
(10) 16·306 miles ÷ 31
(11) 37·2 tons ÷ 34
(12) 65·5 miles ÷ 52

EXAMPLES 3 (d).

(1) If $78 = 8x$, what is the value of x?

(2) If 12 times a certain number is equal to 49·5, what is the number?

(3) Four boys measured a certain rod, and gave the measurement as 15·4 inches, 14·9 inches, 15·25 inches, and 15·1 inches, respectively. Find the average of the four results.

(4) A man walked 142·5 miles in 5 days, beginning each morning at 7 o'clock, and stopping at noon. How far, on the average, does he walk in an hour?

(5) A distance of 63 metres is found to measure very nearly 68·67 yards. Find from this how many yards are equal to one metre.

(6) What is the average length of a man's pace (in yards) if he takes 48 steps in walking a distance of 49·2 yards?

(7) Divide £40 by 38 (to 3 decimal places).

(8) A train consisting of 18 trucks weighs 76·23 tons. What is the average weight in tons of each truck?

Read carefully the following worked exercise—

Ex. On squared paper, carefully trace round the metal rectangle given you, and draw its diagonals. Find, in inches and in centimetres, the difference between its perimeter and the sum of its diagonals. Compare the two answers by multiplying the number of inches by 2·54.

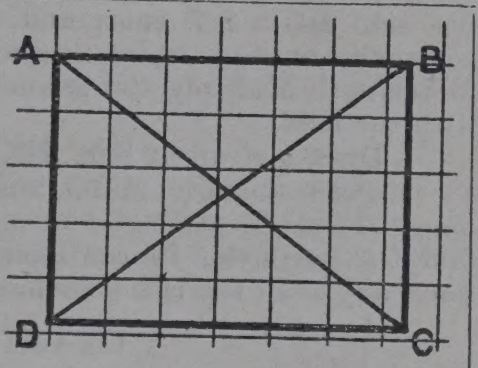

Fig. 1.

Working—

Length of AB	=	3·2 ins. =	8·1 cms.
,, ,, BC	=	2·4 ins. =	6·1 cms.
,, ,, CD	=	3·2 ins. =	8·1 cms.
,, ,, DA	=	2·4 ins. =	6·1 cms.
Perimeter of ABCD	=	11·2 ins. =	28·4 cms.
Length of AC	=	4·0 ins. =	10·15 cms.
,, ,, BD	=	4·0 ins. =	10·15 cms.
Sum of diagonals	=	8·0 ins. =	20·3 cms.
Perimeter	=	11·2 ins. =	28·4 cms.
Sum of diagonals	=	8·0 ins. =	20·3 cms.
Difference	=	3·2 ins. =	8·1 cms.

No. of centimetres = no. of inches × 2·54
= 3·2 × 2·54
= 8·128

And 8·128 is nearly equal to 8·1.

EXAMPLES 3 (e).

(1) Express the following lengths in centimetres. Check your answers by drawing lines of the given length, and measuring them in centimetres.

(*a*) 4·7 inches.
(*b*) 5·9 inches.
(*c*) 6·4 inches.
(*d*) 7·8 inches.
(*e*) 8·3 inches.
(*f*) 9·6 inches.

(2) Express as centimetres—

(*a*) 59 inches.
(*b*) 48 inches.
(*c*) 63 inches.
(*d*) 56 inches.
(*e*) 75 inches.
(*f*) 87 inches.
(*g*) 94 inches.
(*h*) 123 inches.

(3) Draw a rectangle, **ABCD**, with sides 3·5 and 2·7 inches long, and find its perimeter in inches. Measure its sides, and find its perimeter in centimetres. Multiply the first answer by 2·54, and compare it with the second.

(4) Draw a parallelogram, **ABCD**, with the side **AB** = 5·8 cms., the side **BC** = 3·7 cms., and the angle **ABC** = 65°. Find its perimeter in cms. Also measure its sides, and find its perimeter in inches. Multiply the second answer by 2·54, and compare it with the first.

(5) Draw a straight line, **AB**, 1·6 inches long. On **AB** construct an isosceles triangle, **ABC**, with the equal sides each 2·4 inches long. Find its perimeter in inches. Also measure the sides, and find the perimeter in centimetres. Compare the answers in the same way as in the last question.

EXAMPLES 3 (f).

(1) Being given a zinc rectangle, carefully make a drawing of it on squared paper. Measure the rectangle in inches and decimals of an inch, and find—

(*a*) Its perimeter.

(*b*) The length of its two diagonals together.

(*c*) The difference between the length of its long side and of its short side.

(*d*) The difference between the length of its diagonal and one of its short sides.

(*e*) The difference between the sum of its sides and the sum of its diagonals.

Now measure the rectangle in centimetres, and work through all the exercises again. Compare the two sets of answers by multiplying the number of inches by 2·54.

(2) Being given a zinc parallelogram, work through an exactly similar set of exercises.

EXAMPLES 4 (a).

(1) Draw a straight line, **AB**. Place the centre of the protractor at **A**, and the **X** line exactly upon **AB**. Mark the point 30°, and

make an angle **BAC** = 30°. Compare this angle with that of your 30° set square.

(2) In the same way as in (1), draw other straight lines, **AB**, and make angles, **BAC**, of 60° and 45°, testing each of them with a set square.

(3) Make an angle, **BAC**, of 75°. Test it by measuring with two of your set squares placed together.

(4) Construct angles of 75°, 120°, 135°, and 150°, testing each of them with two of the set squares placed together.

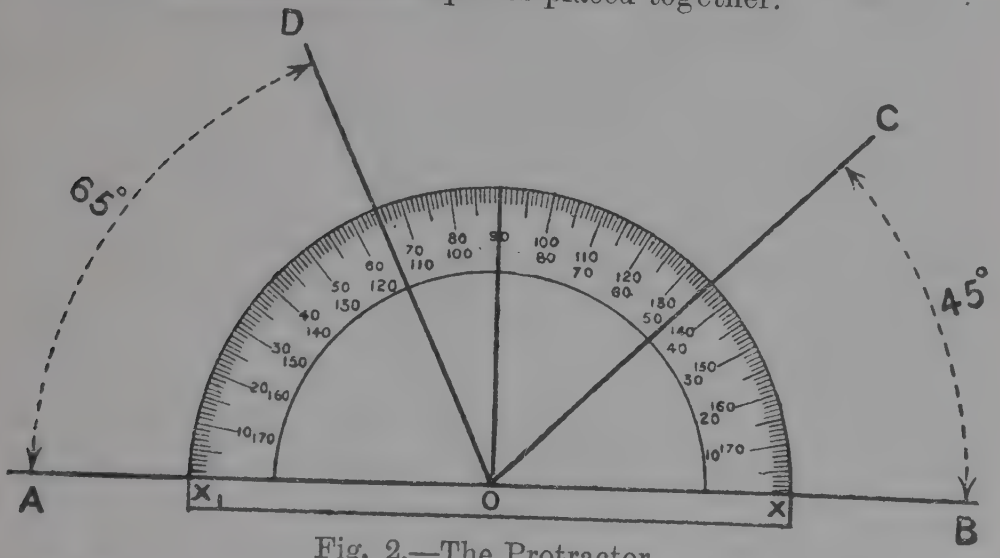

Fig. 2.—The Protractor.

(5) Draw a straight line, **AB**. Place the centre of the protractor at **B**. Using the outer circle of numbers, mark the point 30° and make the angle **ABC** = 30°. Test with your set square.

(6) In the same way as in (5), draw other straight lines, **AB**, and make angles, **ABC**, of 60° and 45°, testing with your set square.

(7) Draw any straight line, **AB**. At the point **B** make an angle, **ABC**, of 75°. Test with two set squares.

(8) Draw a straight line, **PQ**. At the point **Q** make an angle, **PQR**, of 150°. Which circle of numbers will you use? Test your drawing with your two set squares.

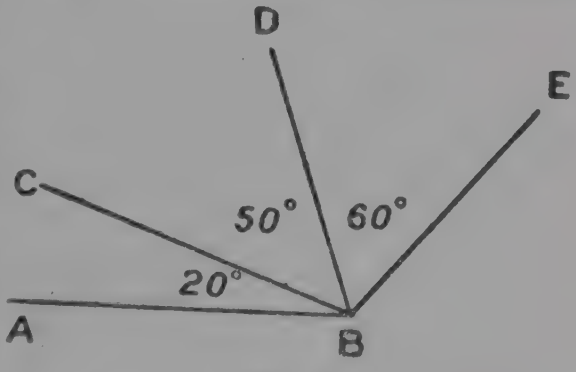

Fig. 3.

(9) Copy the given figure (Fig. 3). Measure the whole angle, **ABE**, with the protractor.

(10) Draw a straight line, **PQ**. At the point **P** make three angles, **QPR**, **RPS**, and **SPT**, of 30°, 50°, and 100° respectively. What is the size of the angle **QPT**?

EXAMPLES 4 (b).

(1) Draw a straight line, **AB**. At the points **A** and **B** make angles **CAB**, **CBA**, each = 60°, so as to form a triangle. Measure the third angle and all the sides of this triangle.

(2) Draw a straight line, **PQ**, and on it construct an equilateral triangle. Measure each of the angles of this triangle.

(3) Draw a straight line, **AB**, 1·5 inches long. On **AB** construct a triangle, **ABC**, having each of the angles at **A** and **B** = 70°. Measure the angle at **C**.

(4) On a straight line, **PQ**, 3 inches long, construct a triangle, **PQR**, having the angle at **P** a right angle, and the angle at **Q** = 35°. Measure the angle at **R**.

(5) Draw a triangle having the sides 3 cms., 4 cms., and 5 cms. long respectively. Measure all the angles of this triangle.

(6) Draw a straight line, **AB**, 2·8 inches in length. On **AB** construct a triangle, **ABC**, having the angle **A** = 35° and the angle **B** = 63°. Measure the angle at **C**.

(7) Draw a triangle, **ABC**, from the following dimensions: **AB** = 3·2 inches. **AC** = 2·7 ins. Angle **BAC** = 65°. Measure the length of **BC**.

(8) Draw a parallelogram, **ABCD**, having the side **AB** = 3 inches, side **AD** = 2·3 inches, and the angle **BAD** = 57°. Measure all the other angles of this parallelogram.

EXAMPLES 5 (a).

(1) Find whether or not these numbers are prime numbers—

65, 93, 79, 57, 143.

(2) Write down the prime factors of

42, 63, 70, 81, 120.

(3) Write down all the composite numbers between 80 and 100.

(4) Find the value of the following—

(*a*) $2 \times 3 \times 5$ (*b*) $2^2 \times 3^2$

(*c*) $2^2 \times 3^2 \times 5$ (*d*) $2 \times 5 \times 7^2$

(*e*) $2^3 \times 3^3$ (*f*) $3^3 \times 5^2$

(5) If $42 = 2 \times x \times 7$, what is the value of the factor **x**?

(6) Find the G.C.M. of

32 and 48; 35 and 42; 39 and 65.

(7) What is the largest number that will divide both 56 and 96?

(8) Find the largest number which will divide into the three numbers, 15, 75, and 50, without remainder.

EXAMPLES 5 (b).

(1) One rod measures 8 ft. long, and another 4 ft. 8 ins. They are to be cut up into equal pieces without waste. What is the greatest possible length of each piece?

(2) One cask contains 4 galls. 2 qts., and another 3 galls. 3 qts. What is the size of the largest measuring can which can be filled an exact number of times from each of them?

(3) What is the largest sum of money that is an exact part of both 5/6 and 7/4?

(4) What is the largest sum of money that is contained an exact number of times both in £1 6*s*. 3*d*. and £1 12*s*. 1*d*.?

(5) One box contains 5 lbs. of tea, and another box $6\frac{1}{4}$ lbs. of tea. The tea is to be made up into equal parcels without mixing the two sorts. What is the weight of each of the largest parcels that can be made?

(6) Find the greatest weight that can be exactly contained in 1 cwt. 1 qr. 16 lbs., and in 1 cwt. 2 qrs. 12 lbs.

EXAMPLES 5 (c).

(1) Write out a series of multiples of the following numbers, and so find, in each case, the least common multiple—

(*a*) 2 and 3. (*b*) 3 and 5.
(*c*) 2, 4, and 8. (*d*) 6, 8, and 12.
(*e*) 2, 4, 8, and 10.

(2) What is the least number into which the following numbers will divide exactly?—

(*a*) 2×3, and 3×5. (*b*) $2^2 \times 3$ and $3^2 \times 2$.
(*c*) $2 \times 3 \times 5$, and $2 \times 3^2 \times 5$. (*d*) $2^2 \times 3 \times 5$, and $2 \times 3^2 \times 5$.

(3) Find the L.C.M. of 20 and 25; of 18 and 24; and of 16 and 40.

(4) Find the L.C.M. of 8, 12, and 20; and of 6, 15, and 18.

(5) What is the smallest number that can be exactly divided by 2, 5, 7, and 10?

(6) Find the L.C.M. of 4, 8, 12, and 16; and of 3, 6, 9, and 12.

(7) Find the least number that can be divided by 3, 5, 7, and 9, and leave a remainder of 1 each time.

(8) Find the L.C.M. of all the numbers which are expressed by a single digit.

EXAMPLES 5 (d).

(1) What is the length of the shortest piece of string that can be cut exactly into lengths of 2, 3, 4, 5, and 6 feet?

(2) What is the shortest length that can be measured exactly by rods measuring 1 ft., 1 ft. 6 ins., and 1 ft. 9 ins.?

(3) What is the smallest sum of money that can be paid exactly in shillings, florins, crowns, and half-sovereigns?

(4) What is the smallest sum of money that can be paid exactly in threepences, fourpences, sixpences, and half-crowns?

(5) What is the smallest number of boys that can be arranged in rows of 8, 12, 18, and 20 each?

(6) A boy has a certain number of marbles. He finds that he can divide this number of marbles into heaps of 12 each, 21 each, 24 each, and 30 each. What is the smallest number of marbles that it is possible for him to have in order to do this?

EXAMPLES 6 (a).

(1) Add together—

(a) $\frac{3}{5}$ of £1, $\frac{2}{3}$ of £1, and $\frac{1}{8}$ of £1.

(b) $\frac{1}{4}$ of 1/-, $\frac{3}{8}$ of 1/-, and $\frac{4}{5}$ of 2/6.

(2) From $\frac{5}{6}$ of £1 take $\frac{7}{12}$ of 1/-; and from $\frac{1}{12}$ of £1 take $\frac{7}{8}$ of 1/-.

(3) Add together $\frac{3}{10}$ of a ton and $\frac{7}{8}$ of a cwt. Give the answer in pounds.

(4) Find the value of—

(a) $\frac{3}{8}$ of £25 6s. 8d. (b) $\frac{5}{6}$ of 4 yds. 2 ft.

(c) $\frac{6}{11}$ of 1 mile. (Ans. in yards.)

(5) If $\frac{3}{8}$ of my money is 30/-, how much money have I?

(6) How many pounds are there in $\frac{3}{7}$ of a ton?

(7) A running track is $\frac{1}{4}$ of a mile long. What is its length in yards?

(8) A cricket team made altogether 192 runs. One of the men made $\frac{5}{12}$ of the runs. How many did he make?

EXAMPLES 6 (b).

(1) Convert all these fractions to twelfths—

$\frac{3}{4}$, $\frac{2}{3}$, $\frac{1}{2}$, and $\frac{5}{6}$.

(2) What is the value of x in each of the following?—

(a) $\frac{3}{5}$ of a ton = $\frac{x}{20}$ of a ton. (b) $\frac{5}{8}$ of a lb. = $\frac{x}{32}$ of a lb.

(c) $\frac{27}{36}$ of £1 = $\frac{x}{4}$ of £1. (d) $\frac{16}{24}$ of 1/- = $\frac{x}{3}$ of 1/-

(3) Write down a fraction, with 8 as its denominator, and equal to $\frac{12}{16}$.

(4) Write down a fraction, having 9 as its numerator, and equal to $\frac{18}{20}$.

(5) Find the value of x in each of the following—

(a) $\frac{10}{12} = \frac{5}{x}$ (b) $\frac{5}{8} = \frac{25}{x}$

(c) $\frac{12}{20} = \frac{3}{x}$ (d) $\frac{12}{32} = \frac{3}{x}$

(6) Draw a rectangle and divide it so as to show that $\frac{5}{6} = \frac{15}{18}$.

(7) Draw another rectangle and divide it so as to show that $\frac{9}{24} = \frac{3}{8}$.

(8) Reduce all these fractions to hundredths. Then express each of the fractions as a decimal, and compare the results—

$\frac{4}{5}$, $\frac{3}{10}$, $\frac{4}{25}$, $\frac{12}{20}$, $\frac{3}{4}$.

EXAMPLES 6 (c).

(1) Reduce these fractions to their lowest terms—

$\frac{5}{10}$, $\frac{15}{20}$, $\frac{15}{24}$, $\frac{6}{21}$, $\frac{9}{27}$, $\frac{28}{32}$.

(2) Which is the greater: $\frac{5}{7}$ of a cwt. or $\frac{3}{5}$ of a cwt.; $\frac{3}{4}$ of a ton or $\frac{5}{6}$ of a ton?

(3) Convert $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$ to twenty-fourths.

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(4) Convert $\frac{6}{8}$, $\frac{3}{12}$, $\frac{12}{16}$, and $\frac{15}{20}$ to quarters.

(5) Convert to tenths: $\frac{5}{25}$, $\frac{21}{30}$, $\frac{40}{50}$, and $\frac{60}{100}$.

(6) Convert to hundredths: $\frac{3}{4}$, $\frac{1}{2}$, $\frac{2}{5}$, and $\frac{3}{10}$.

In the remaining questions, check each of your answers by converting the fractions to decimals, to two places.

(7) Arrange these fractions in order, putting the smallest first—

$\frac{3}{4}$, $\frac{13}{16}$, and $\frac{5}{8}$.

(8) Add together the greatest and least of these fractions—

$\frac{3}{8}$, $\frac{1}{6}$, $\frac{5}{12}$, and $\frac{1}{4}$.

EXAMPLES 6 (d).

(1) Draw a straight line and divide it so as to show that $3\frac{5}{8} = \frac{29}{8}$.

(2) Draw a straight line and divide it to show that $\frac{34}{5} = 6\frac{4}{5}$.

(3) How many eighths of a pound are there in £6? In £9? In £12?

(4) Write in the simplest form—

£$\frac{72}{12}$, £$\frac{64}{8}$, £$\frac{56}{7}$, £$\frac{45}{9}$, and £$\frac{54}{6}$.

(5) Express as improper fractions—

$2\frac{3}{4}$, $4\frac{5}{6}$, $5\frac{3}{8}$, $3\frac{5}{12}$, $6\frac{5}{9}$.

(6) Express as mixed numbers, with fractions in lowest terms—

$\frac{18}{8}$, $\frac{15}{6}$, $\frac{27}{12}$, $\frac{35}{10}$, $\frac{36}{16}$.

(7) How many tenths of an inch are in $4\frac{7}{10}$ inches? Check your answer by drawing a diagram.

(8) Draw a rectangle and divide it to show that $\frac{2}{3} = \frac{16}{24}$.

Read this worked exercise carefully.

Ex. Add together $\frac{3}{4}$ and $\frac{5}{8}$. Check your answer by converting the fractions into decimals.

Working:

$$\frac{3}{4} + \frac{5}{8} = \frac{6}{8} + \frac{5}{8} = \frac{11}{8}$$
$$= 1\frac{3}{8}. \quad \textit{Ans.}$$

$\frac{3}{4} = \cdot 75$ and $\frac{5}{8} = \cdot 625$.

$$\cdot 75 + \cdot 625 = 1 \cdot 375$$
$$= 1\frac{375}{1000} = 1\frac{3}{8}. \quad \textit{Ans.}$$

EXAMPLES 7 (a).

Work these addition and subtraction sums. Then convert the fractions into decimals, and work the same sums in decimals. Compare the answers.

(1) $\frac{1}{2}$ of a ton + $\frac{4}{5}$ of a ton

(2) $\frac{1}{2}$ of a pound + $\frac{7}{10}$ of a pound

(3) $\frac{1}{4}$ of a gallon + $\frac{3}{8}$ of a gallon

(4) $\frac{7}{8}$ of a yard + $\frac{3}{4}$ of a yard

(5) $\frac{7}{8}$ of a yard − $\frac{1}{2}$ of a yard

(6) $\frac{3}{4}$ of a pound − $\frac{1}{8}$ of a pound

(7) $\frac{1}{2}$ of a ton − $\frac{2}{5}$ of a ton

(8) $\frac{5}{8}$ of a metre − $\frac{1}{2}$ of a metre

EXAMPLES 7 (b).

(1) Add together, and check your answers by drawing diagrams—
(*a*) $\frac{3}{8}$ and $\frac{1}{6}$ (*b*) $\frac{1}{4}$ and $\frac{2}{5}$ (*c*) $\frac{2}{3}$ and $\frac{5}{8}$

(2) Find the difference between—
(*a*) $\frac{7}{8}$ and $\frac{1}{2}$ (*b*) $\frac{8}{9}$ and $\frac{5}{12}$ (*c*) $\frac{4}{5}$ and $\frac{3}{4}$

(3) Which is the greater, and by how much: $\frac{4}{5}$ or $\frac{5}{6}$?

(4) I spent $\frac{1}{3}$ of my money, and then $\frac{3}{8}$ of it. What fraction of my money did I spend altogether?

(5) Find the sum of £$\frac{5}{6}$ and £$\frac{3}{8}$. Work this in two different ways.

(6) A carpenter took a plank $\frac{7}{8}$ of an inch thick, and planed it down till the thickness was $\frac{11}{16}$ of an inch. What thickness of wood did he remove?

(7) One workman does $\frac{1}{3}$ and another $\frac{1}{4}$ of a piece of work. What fraction of the work do they do between them?

(8) Two boys measured the thickness of a rod. One found it to be $\frac{7}{8}$ of an inch thick, and the other $\frac{9}{10}$ of an inch thick. What was the difference between the two measurements?

EXAMPLES 7 (c).

Work these sums in addition and subtraction of fractions. Then change the fractions into decimals, and work the same sums in decimals. Compare the answers.

(1) $2\frac{1}{2}$ pounds + $3\frac{1}{5}$ pounds
(2) 3 tons − $1\frac{7}{8}$ tons
(3) $2\frac{1}{4}$ yards − $1\frac{3}{4}$ yards
(4) $3\frac{1}{2}$ inches + $1\frac{5}{8}$ inches
(5) $1\frac{3}{4}$ metres − $\frac{7}{8}$ of a metre
(6) $2\frac{3}{8}$ pounds − $1\frac{3}{4}$ pounds
(7) $4\frac{1}{4}$ ounces + $2\frac{1}{8}$ ounces
(8) $2\frac{1}{2}$ feet + $2\frac{5}{8}$ feet

EXAMPLES 7 (d).

(1) From 3 take $\frac{4}{7}$; from 5 take $\frac{4}{9}$; and from 4 take $\frac{3}{11}$.

(2) A boy spent $\frac{5}{7}$ of his money, and then had 10*d.* left. How much money had he at first?

(3) I drew off from a cask $\frac{4}{7}$ of its contents. What fraction of the contents remained in the cask?

(4) A boy gave away $\frac{3}{11}$ of a cake, and ate the rest. What fraction of the cake did he eat?

(5) After rubbing out $\frac{1}{3}$ of a line, the length of the remainder was 18 inches. What was the length of the line at first?

(6) If $\frac{4}{9}$ of a barrel of flour costs 18/-, what does a barrel of flour cost?

(7) After selling $\frac{5}{9}$ of his flock, a farmer had 48 sheep left. How many had he at first?

(8) In a school of 175 children, $\frac{3}{7}$ were boys. How many girls were there?

EXAMPLES 7 (e).

(1) By how much is $3\frac{1}{6}$ greater than $2\frac{3}{5}$?

(2) Find a fraction that is greater than $1\frac{1}{3}$ by $1\frac{1}{8}$.

(3) The sum of two fractions is $3\frac{5}{8}$. One of them is $2\frac{1}{3}$. What is the other?

(4) A plank measured $10\frac{3}{5}$ feet. A piece $3\frac{2}{3}$ feet long was cut off. What was the length of the remainder?

(5) The difference between two fractions is $1\frac{1}{4}$. The greater of them is $2\frac{4}{7}$. What is the other?

(6) I start to walk to a place $7\frac{1}{2}$ miles away. How many miles have I still to go when I have walked $4\frac{2}{3}$ miles?

Prove your answer by drawing a straight line, taking 1 inch to represent 1 mile.

(7) A man is 6 feet $1\frac{3}{4}$ inches tall in his boots. If the boots make him $\frac{7}{8}$ of an inch taller than he really is, what is his true height?

(8) If $1\frac{3}{4}$ gallons of water are poured into a pail which will hold $2\frac{1}{2}$ gallons, how many more gallons are needed to fill the pail?

EXAMPLES 8.

(1) Draw two straight lines, AB and CD, cutting or *intersecting* one another at the point O. Count the number of angles made. Write down their names.

The angles AOC and DOB are called *opposite angles.*

AOD and COB are also *opposite angles.*

The angles AOC and AOD are called *adjacent angles.*

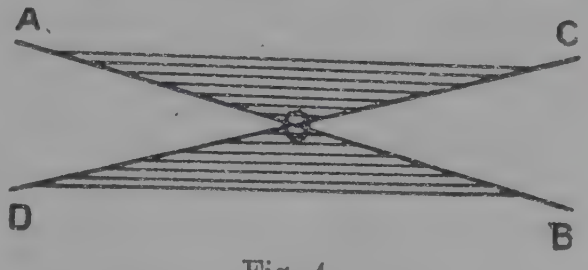

Fig. 4.

COB and DOB are also *adjacent angles.*

Write down the names of any other adjacent angles in the figure.

(2) Draw two straight lines, PQ and RS, intersecting in the point O. Measure with the protractor, and write down the number of degrees in the angles POR, ROQ, QOS, SOP.

(3) Draw two straight lines, AB and CD, intersecting at O, and making the angle AOD 60°. Measure the angle COB.

(4) Draw two straight lines, AB and CD, intersecting at O, and making the angle AOC 45°. How many degrees are there in the angle BOD? Measure to see if your answer is right.

(5) Draw a pair of intersecting lines, so that the four angles made by them are equal to one another.

Learn :—When two straight lines intersect, the opposite angles are equal to one another.

(6) Draw a straight line, **AB**, and mark any point **C** in the line. At the point **C** make an angle **DCB** = 40°. Measure the angle **DCA** and complete the statement

DCA + DCB = degrees.

(7) Draw a straight line, **PQ**, and mark any point **R** in this line. From the point **R** draw any other straight line, **RS**. Measure the angles **SRP**, **SRQ**, and add them together.

(8) Draw a straight line, **AB**, and from any point **C** in this line draw a second line, **CD**, making an angle **DCA** = 70°. How large is the angle **DCB**? Measure to see if your answer is right.

Learn :—When one straight line meets another straight line, the two adjacent angles are together equal to 180°.

(9) Draw two straight lines, **AB**, **CB**, meeting one another at the point **B**. From **B** draw a third straight line, **BD**, so that the two angles **ABC** and **ABD** = 180°.

(10) Draw a straight line, **AB**, and from any point **C** in this line draw another straight line, **CD**. Bisect the angles **DCA**, **DCB**, by the straight lines **CE**, **CF**. Measure the angle **ECF**.

(11) Draw two adjacent angles, as in No. 10. Bisect one of them (**DCA**) by the straight line **CE**. At the point **C** draw the straight line **CF** at right angles to **CE**. Measure the angles **DCE**, **ECA**.

(12) Draw two adjacent angles, such that one of them is (*a*) double of the other; (*b*) equal to three times the other.

Read carefully these worked examples.

(1) Reduce £14 16*s.* 8*d.* to pence.

(2) How many pence are equal to £12·435?

Working. (1)

£	*s.*	*d.*
14	16	8
20		
296*s.*		
12		
3560*d.*		

(2)

£
12·435
20
248·70*s.*
12
2984·4*d.*

(3) Express 3642 pence (*a*) as £ *s.* *d.*, (*b*) as pounds and decimals of a pound.

Working. (*a*)

pence	
12	3642
20	303*s.* 6*d.*
	£15 3*s.* 6*d.*

(*b*)

pence	
12	3642
20	303·5 shillings.
	15·175 pounds.

EXAMPLES 9 (a).

(1) How many pounds and shillings are equal to—
(*a*) **369** shillings; (*b*) **526** shillings; (*c*) **735** shillings?
(2) How many shillings and pence are equal to—
(*a*) **159** pence; (*b*) **2130** pence; (*c*) **2565** pence?
(3) Express as shillings—
(*a*) **222** pence; (*b*) **153** pence; (*c*) **47·4** pence.
(4) Reduce to pence—
(*a*) **£21·5**; (*b*) **£21·75**; (*c*) **£12·35**.
(5) Express as pounds and decimals of a pound—
(*a*) **4599** pence; (*b*) **3765** pence; (*c*) **2907** pence.
(6) Convert to shillings, giving the answers correct to the third decimal place—
(*a*) **768** farthings; (*b*) **1635** farthings; (*c*) **2736** farthings.
(7) Reduce to farthings—
(*a*) **£17·3**; (*b*) **£36·25**; (*c*) **£9·375**.
(8) Convert to pounds, giving the answers correct to the third decimal place—
(*a*) **1675** pence; (*b*) **2389** pence; (*c*) **3465** pence.
(9) Reduce to farthings—
(*a*) **£4 16***s.* **0***d.*; (*b*) **£5 17***s.* **8***d.*; (*c*) **£6 13***s.* $4\frac{1}{2}d.$
(10) Express as £ *s. d.*—
(*a*) **2735** pence; (*b*) **5169** farthings; (*c*) **7245** farthings.
(11) How many three-halfpences are equal in value to—
(*a*) **£5 17***s.* **0***d.*; (*b*) **£3 14***s.* **6***d.*; (*c*) **£7 13***s.* **3***d.*?
(12) How many pounds, etc., are worth as much as—
(*a*) **1235** sixpences; (*b*) **1369** fourpences; (*c*) **2125** threepences?

EXAMPLES 9 (b).

(1) How many lbs. of meat at **10***d.* per lb. can be purchased for **14/7**?
(2) If the French coin called a Franc is worth $9\frac{3}{4}d.$, how many francs are equal in value to **13/-**?
(3) From **100** guineas I pay away **£82 15***s.* **3***d.* How many threepennypieces is my remaining money worth?
(4) A grocer sold **25** cheeses, each weighing **46** pounds, at the rate of **5***d.* a pound. How much did he receive for them?
(5) How many ounces of tobacco at **4***d.* an ounce can be bought for **£1 13***s.* **4***d.*?
(6) If oranges are sold at the rate of **4** for **3***d.*, how many can be obtained for **£2 17***s.* **9***d.*?
(7) How many books at **2/6** each can be bought for **£12 7***s.* **6***d.*?
(8) An outfitter bought a number of hats at **3/4** each. The bill for them came to **£9 16***s.* **8***d.* How many hats did he buy?

EXAMPLES 9 (c).

(1) A man's weekly wages amount to 3 guineas. He pays 18/6 for lodgings, 25/- for food, and 9/8 for other expenses. How much does he save per week?

(2) A man owed a debt of £50. At different times he repaid £12 13*s.* 6*d.*, £18 18*s.* 0*d.*, and £5 17*s.* 6*d.* How much does he still owe?

(3) After paying for a railway ticket, a person received £2 18*s.* 4*d.* as change out of a five-pound note. If the fare is 1 penny a mile, how many miles can he travel with the ticket?

(4) A farmer bought 3 cows for £42 11*s.* 6*d.* The first cost him £12 13*s.* 6*d.*, and the second £14 7*s.* 6*d.* What was the price of the third?

(5) A dealer bought two horses for £64 12*s.* 6*d.* He afterwards sold one of them for 40 guineas, and the other for £32 5*s.* 0*d.* What profit did he make?

(6) In three months a man's earnings amounted to £78 15*s.* 6*d.* In the first month he earned £21 13*s.* 4*d.*, and in the second month £28 17*s.* 6*d.* How much did he earn in the third month?

(7) A man bought a horse for 27 guineas and a cow for £15 17*s.* 6*d.* He sold the two for £46 13*s.* 0*d.* What did he gain?

(8) From the sum of £56 13*s.* $8\frac{1}{2}d.$ and £108 12*s.* $10\frac{3}{4}d.$ take £88 17*s.* $9\frac{1}{2}d.$

EXAMPLES 9 (d).

(1) Find the value of 37 articles at £1 7*s.* 10*d.* each.

(2) If a man's weekly wages are £1 17*s.* 6*d.*, how much does he earn in a year of 52 weeks?

(3) Find the total cost of 16 framed pictures, the price of each picture being 16/9, and of each frame $4/7\frac{1}{2}$.

(4) The price of a bicycle is 15 guineas, and this amount is to be paid in six monthly instalments. What does the monthly payment amount to?

(5) A farmer bought 8 cows for £100, and sold them so as to gain £11 altogether. What was the average selling price of each cow?

(6) A man earns £130 a year, and spends £2 5*s.* 6*d.* every week. What do his yearly savings amount to?

(7) What is spent in a month of 31 days at the rate of £1 16*s.* 7*d.* per day?

(8) The total wages of 9 men came to £16 11*s.* 6*d.* How much was paid, on the average, to each man?

EXAMPLES 9 (e).

Make out bills for the following:—

(1) 14 lbs. of sugar at $4\frac{1}{2}d.$ per lb.; 18 lbs. of tea at 1/10 per lb.; 7 lbs. of rice at $3\frac{3}{4}d.$ per lb.; 9 lbs. of butter at $1/4\frac{1}{2}$ per lb.

(2) 12 yards of flannel @ 1/11 per yard; 15 yards of calico at $6\frac{3}{4}d.$ per yard; $7\frac{1}{2}$ yards of linen at 2/4 per yard; 23 yards of ribbon at $3\frac{1}{2}d.$ per yard.

(3) 250 oranges at 3/6 per 100; 96 lemons at 1/3 per dozen; 15 lbs. of grapes at $1/4\frac{1}{2}$ per lb.; 15 gallons of nuts @ 1/2 per gallon.

(4) $3\frac{1}{2}$ lbs. of beef at $9d.$ per lb.; 11 lbs. 8 ozs. of pork at $10\frac{1}{2}d.$ per lb.; 6 lbs. 12 ozs. of salt beef at $8d.$ per lb.; 13 lbs. of mutton at 1/1 per lb.

(5) 1 ham weighing $12\frac{1}{2}$ lbs. at $8\frac{1}{2}d.$ per lb.; 6 score eggs at $10d.$ per dozen; 14 lbs. of butter at $1/2\frac{1}{2}$ per lb.; 2 pairs of fowls at 3/9 each.

(6) 13 yds. of dress material at $2/6\frac{1}{2}$ per yd.; $8\frac{1}{2}$ yds. of lining at $4\frac{1}{2}d.$ per yd.; 1 dozen yards of trimming at $6\frac{3}{4}d.$ per yd.; 3 doz. buttons at $8\frac{3}{4}d.$ per dozen.

Read these worked examples carefully.

(1) Reduce 15 cwts. 3 qrs. 12 lbs. to lbs.
(2) Reduce 12·375 cwts. to lbs.

Working.

(1)

cwts.	qrs.	lbs.
15	3	12
4		
63 qrs.		
28		
126		
504		
12		
1776 lbs.		

(2)

cwts.
12·375
4
49·500 qrs.
28
990·
396·0
1386·0 lbs.

EXAMPLES 10 (a).

Reduce—

(1) 7 yds. 2 ft. 8 ins. to inches.
(2) 9·125 yds. to inches.
(3) 9 galls. 3 qts. 1 pt. to pints.
(4) 12·875 galls. to pints.
(5) 4 bush. 3 pks. 1 gall. to gallons.
(6) 13·625 bushels to gallons.
(7) 5 tons 3 cwts. 2 qrs. to qrs.
(8) 7·364 tons to qrs.
(9) 15 cwts. 3 qrs. 16 lbs. to lbs.
(10) 8·245 cwts. to lbs.
(11) 3 qrs. 5 lbs. 6 ozs. to ozs.
(12) 1·785 qrs. to ozs.

Read these worked examples carefully.

Ex. Convert **2137** lbs. to (*a*) cwts., etc., (*b*) cwts. and decimals (two places).

Working.

(*a*)

lbs.

28 ⟨ 4 | 2137
⟨ 7 | 534 pkts. of 4 lbs. + 1 lb. } 9 lbs.
4 | 76 qrs. + 2 pkts. of 4 lbs. }
19 cwts. + 0 qrs.

19 cwts. **0** qrs. **9** lbs.

(*b*)

lbs.

28 ⟨ 4 | 2137
⟨ 7 | 534·25 pkts. of 4 lbs.
4 | 76·32...qrs.
19·08...cwts.

EXAMPLES 10 (b).

(1) How many yds., ft., and ins. are equal to (*a*) **385** inches; (*b*) **769** inches; (*c*) **1028** inches?

(2) Express as gallons and decimals of a gallon, (*a*) **683** pints, (*b*) **598** pints, (*c*) **957** pints.

(3) Convert to bushels (correct to **3** decimal places), (*a*) **456** galls., (*b*) **537** galls., (*c*) **743** galls.

(4) Express as tons, cwts., and qrs., (*a*) **137** qrs., (*b*) **256** qrs., (*c*) **549** qrs.

(5) Express as cwts. and decimals of a cwt. (**3** places), (*a*) **945** lbs., (*b*) **587** lbs., (*c*) **1264** lbs.

EXAMPLES 10 (c).

(1) How many yards, etc., of wire are required to make **1850** nails, each one inch in length?

(2) How many pint bottles will be required to hold $15\frac{1}{2}$ gallons of ale?

(3) How many tons of coal are there in **235** sacks, each containing **2** cwts.?

(4) A quantity of tea weighing **3** tons **17** cwts. is made up into pound packets. How many packets are there?

(5) In a certain regiment there were **548** men, and each man, at Christmas, received $\frac{1}{4}$ of a pound of tobacco. How much tobacco (cwts. and lbs.) was required?

(6) A train started on a journey at **10.45** a.m., and reached its destination at **4.18** p.m. How many hours and minutes did the journey take?

(7) How many bottles, each holding a pint and a half, can be filled from a barrel holding 18 gallons?

(8) How many 4 ounce packets of tobacco can be made up from 2 cwts. 1 qr. 12 lbs. of tobacco?

(9) How many sacks, each holding 100 lbs., can be filled from 5 tons of flour?

(10) How many parcels, each weighing $2\frac{1}{2}$ lbs., will weigh together 5 cwts.?

(11) A man who works 8 hours a day can make a certain article in 20 minutes. How many such articles can he make in his working day? If he receives $4\frac{1}{2}d.$ for each article he makes, what does he earn in a day?

(12) If a boy's step is 1 ft. 9 ins., how many steps will he take in walking a distance of 189 yards?

EXAMPLES 10 (d).

(1) Three parcels weigh 56 lbs., 14 lbs., and 7 lbs. respectively. How much less than 1 cwt. is their total weight?

(2) How much milk does a man sell altogether in 3 days, if he sells 10 galls. 1 qt. on the first day, 15 galls. 1 qt. 1 pt. on the second day, and 22 galls. 1 qt. 1 pt. on the third day?

(3) The total length of a post is $12\frac{1}{2}$ yards. It is driven into the bed of a river, so that 3 yards 2 ft. 9 ins. remain above the level of the water. How long is the portion that is below the water level?

(4) A post is driven into the bed of a river, so that 1 yard 1 ft. 9 ins. is in the ground, 2 yards 2 ft. 4 ins. in the water, and 1 yard 2 ft. 5 ins. above the water. What is the total length of the post?

(5) A mixture of two substances weighs $8\frac{1}{2}$ pounds. The weight of one of the substances is 3 lbs. 10 ozs. What is the weight of the other?

(6) A cart full of coal weighs 1 ton 17 cwts. 2 qrs. The empty cart weighs 18 cwts. 3 qrs. What weight of coal does it contain?

(7) An engine loaded with coal and water weighs 42 tons 15 cwts. The water and coal together weigh 4 tons 18 cwts. What is the weight of the engine itself?

(8) Find the sum of 3 cwts. 2 qrs. 14 lbs.; 5 cwts. 1 qr. 21 lbs.; and 9 cwts. 1 qr. 7 lbs.

EXAMPLES 10 (e).

(1) Find the weight of 7 sacks of corn, each weighing 1 cwt. 3 qrs. 14 lbs.

(2) A train consists of 11 trucks, and the average weight on each truck is 7 tons 13 cwts. What is the weight of the total load on the train?

(3) If 9 pails, each holding 2 galls. 3 qts. 1 pt., are filled from a cistern holding 50 gallons, what quantity is left in the cistern?

(4) What length of string will be required for 47 parcels if each parcel requires 2 ft. 4 inches of string?

(5) Find the weight of **20** bales of cloth, each weighing **7** cwts. **1** qr. **21** lbs.

(6) The wheels of a cart are **12** ft. **9** ins. in circumference. How far has the cart travelled when the wheel has turned round **32** times?

(7) If I walk at the rate of **1** mile in **19** minutes **15** seconds, how long will it take me to walk **18** miles?

(8) In travelling a distance of **19** yds. **2** ft. **9** ins., the front wheel of a cart turned round **9** times and the back wheel **6** times. Find the circumference of each wheel.

EXAMPLES 10 (f).

(1) Find the value of **3** cwts. of sugar at $2\frac{1}{2}d.$ per lb.

(2) A milkman bought milk at $9\frac{1}{2}d.$ a gallon, and sold it at $2\frac{1}{4}d.$ a pint. If he sold $12\frac{1}{2}$ gallons, what was his gain?

(3) Sugar was bought at **21/9** per cwt., and sold at $3\frac{1}{4}d.$ a pound. What was the profit on each cwt.?

(4) How many gallons of wine are contained in **20** dozen pint bottles? What is the price of this quantity at **18/9** per gallon?

(5) A man works from **7.30** a.m. till **8** p.m., being allowed **1** hour **40** minutes for meals. If he is paid at the rate of **9***d.* an hour, what is his daily wage?

(6) If tobacco is bought at the rate of $4/3\frac{1}{2}d.$ per lb., and sold at $4\frac{1}{2}d.$ per ounce, what is the profit on **14** lbs. of tobacco?

(7) Ten "pieces" of paper were required to paper a room. If each piece contained $3\frac{1}{2}$ yards and was sold at the rate of **5***d.* per yard, what was the cost of the paper for the room?

(8) A quantity of tea weighing **3** cwts. was bought for £7. It was sold in quarter-pound packets at $4\frac{1}{2}d.$ per packet. What was the gain?

EXAMPLES 11.

(1) Draw two parallel straight lines, **AB** and **CD**, and a third line, **EF**, just meeting each of them, as shown in Fig. 5.

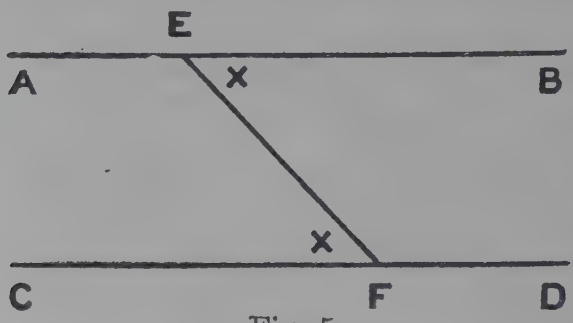

Fig. 5.

Place a cross inside the angles **BEF** and **EFC**. These angles are called *alternate* angles. Can you see another pair of alternate angles?

(2) Draw two parallel straight lines, **AB**, **CD**, and a third line, **EF**, just meeting each of them. Measure, and write down the size of the four angles, **BEF**, **EFD**, **AEF**, **EFC**. What do you notice about the alternate angles?

(3) Draw two parallel straight lines, **PQ**, **RS**. In **PQ** take any

point **M**, and from **M** draw a third straight line, **MN**, meeting the line **RS** in **N**, and making the angle **QMN** = 45°. Write down the value in degrees of the other three angles. Measure with protractor to see if your answer is right.

(4) Using only your ruler, draw any two straight lines which do not meet. Draw another line crossing these two, and try whether the two lines are parallel or not.

(5) Copy the given figure (Fig. 6). Through the point **D** draw a straight line parallel to **AB**.

(6) Draw two parallel lines, **AB** and **CD**, about **1** inch apart. Draw another straight line, **EFGH**, cutting the parallel lines at the points **F** and **G**, as shown in Fig. 7.

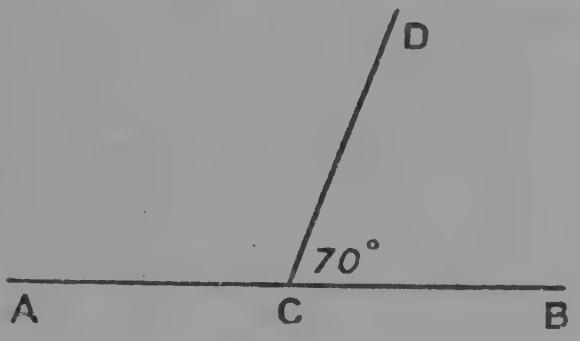

Fig. 6.

The angles **EFB** and **FGD** are called *corresponding* angles. The angles **EFA** and **FGC** are also corresponding angles.

Pick out any other pairs of corresponding angles that you can see.

(7) Draw two parallel lines and a third line intersecting them, as shown in Fig. 7. Measure and write down the sizes of the angles **EFB** and **FGD**. Also of the angles **AFG**, **CGH**, and of the angles **EFA**, **FGC**. Write down what you notice about these corresponding angles.

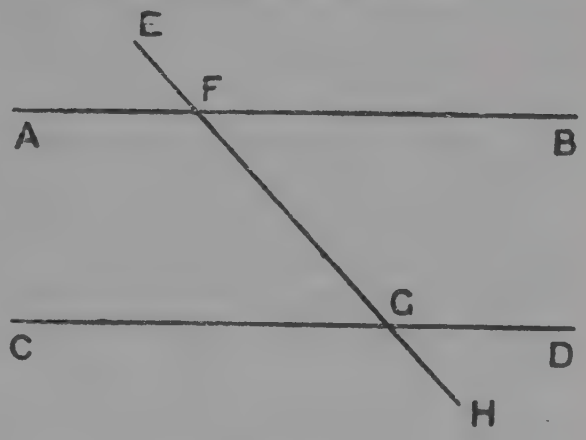

Fig. 7.

(8) Draw another diagram similar to Fig. 7, but making the angle **EFA** = 60°. How many degrees are there in the angle **FGC**? Measure to see if your answer is right.

(9) Draw any straight line, **AB**. Using ruler and compasses only, draw another line parallel to **AB**.

(10) Draw any straight line, **EF**. Using ruler and protractor only, draw another straight line parallel to **EF**.

(11) Draw any straight line, **MN**. Using ruler and set square only, draw another straight line parallel to **MN**.

(12) Draw two parallel lines, and a third line intersecting them, as shown in Fig. 7. Count the number of angles made in this figure. Copy, on tracing paper, the angle **EFB**, and find all the angles which are equal to **EFB**. Mark them with an **X**. Also

copy on tracing paper the angle **EFA**, and mark with an **O** all the angles which are equal to **EFA**.

(13) Draw another figure similar to Fig. 7. Measure with your protractor all the angles made, and write down the number of degrees in each angle.

(14) Draw two parallel lines, and a third line meeting them, as in Fig. 5. Measure with your protractor the angles **BEF** and **EFD**, and add the measurements together. Also measure the angles **AEF** and **EFC**, and add these measurements together. What do you notice about the results?

(15) Draw two straight lines, **AB**, **AC**, meeting at **A**, and making an angle, **BAC**. Mark any point **X** within this angle. Through **X** draw **XY** parallel to **AB**, and **XZ** parallel to **AC**. Measure the angles **BAC** and **YXZ**.

Enter in Note Book and learn:—
When a straight line cuts two parallel straight lines—
The alternate angles are equal.
The corresponding angles are equal.
The interior angles on one side of the cutting line are equal to **180°**.

PART II

EXAMPLES 12 (a). (Revision.)

(1) If **15** balls of string, each containing **64** yards, were cut into lengths of **16** yards, how many such lengths would there be?

(2) Three trains, each carrying **249** people, set out on a journey. During the journey **179** people got out of the trains and **97** other people entered them. How many people arrived at the journey's end?

(3) A regiment of **916** men went to a certain war. During the war **245** of the men were either killed or sent home, and **186** fresh men were sent to the regiment. How many men were in the regiment at the close of the war?

(4) The total weight of **27** sacks of grain is **1701** pounds. What is the average weight per sack?

(5) A baker used **2356** pounds of flour in **34** days. What was the average amount of flour used per day?

(6) A steamer requires on an average **73** tons of coal per day. How many days will **2044** tons last?

(7) The total wages paid to a number of men was **£116**. If there were **48** men, find, to the nearest tenth of a pound, the average wages received by each man.

(8) It is found that the total amount of water that can be put into **68** vessels is **240** gallons. Find, to the nearest tenth, the average amount contained in each vessel.

EXAMPLES 12 (b).

(1) When $a = 9$, find the value of

(i.) $7a$ (ii.) $15a$ (iii.) $26a$ (iv.) $37a$

(v.) $\frac{36}{a}$ (vi.) $\frac{216}{a}$ (vii.) $\frac{a}{3}$ (viii.) $\frac{a}{36}$

(2) Work Question 1 again, supposing that $a = 36$.

(3) If $x = 8$, find the value of

(i.) $x(15 + 24)$ (ii.) $x(63 - 18)$

(iii.) $\frac{25 + 15}{x}$ (iv.) $\frac{87 - 23}{x}$

(4) Work Question 3 again, supposing that $x = 16$.

(5) When $a = 4$, find the value of

(i.) $13a + 12a$ (ii.) $a(13 + 12)$

(6) Work Question 5 again, supposing that $a = 12$, and again, supposing $a = 25$.

(7) If $y = 6$, find the value of

(i.) $(32 - 17)y$ (ii.) $32y - 17y$

(8) Work Question 7 again, supposing that $y = 9$, and again, supposing $y = 16$.

EXAMPLES 12 (c).

(1) Find the value of ab:

(i.) When $a = 7$ and $b = 5$ (ii.) When $a = 15$ and $b = 12$

(iii.) When $a = 26$ and $b = 23$ (iv.) When $a = 75$ and $b = 45$

(2) Find the value of $\frac{a}{b}$:

(i.) When $a = 18$ and $b = 3$ (ii.) When $a = 64$ and $b = 16$

(iii.) When $a = 72$ and $b = 9$ (iv.) When $a = 350$ and $b = 25$

(3) What is the value of x in each of the following?—

(i.) $\frac{36}{4} + \frac{28}{4} = x$ (ii.) $\frac{36 + 28}{4} = x$

(4) Find the value of

(i.) $\frac{45}{9} - \frac{27}{9}$ (ii.) $\frac{45 - 27}{9}$

(5) If $a = 7$, find in two different ways the value of $\frac{84}{a} + \frac{49}{a}$.

(6) If $a = 18$ and $b = 12$, find the value of

(i.) $\frac{a + b}{6}$ (ii.) $\frac{a}{6} + \frac{b}{6}$

(iii.) $\frac{a - b}{6}$ (iv.) $\frac{a}{6} - \frac{b}{6}$

(7) Work Question 6 again, supposing that $a = 72$ and $b = 48$.

(8) If $x = 81$, and $y = 45$, find in two different ways the value of $\frac{x + y}{9}$ and of $\frac{x - y}{9}$.

EXAMPLES 13 (a).

(1) Draw, with ruler and set squares, several parallelograms. Using compasses, protractors, etc., measure the parallelograms, and answer the following questions about them—

(*a*) Are all the sides of a parallelogram equal to one another?
(*b*) Which sides are equal?
(*c*) Are all the angles of a parallelogram equal to one another?
(*d*) Which angles are equal?

(2) Draw a parallelogram with all its sides equal. What other name can you give to this figure?

(3) Draw a parallelogram with all its angles equal. What are these angles? What other name can you give to this figure?

(4) Draw a parallelogram with all its sides equal and all its angles equal to one another. What is this figure?

(5) Write in your own words what you mean by a parallelogram, a rhombus, a rectangle, and a square.

(6) Draw a parallelogram, a rhombus, a rectangle, and a square.

(7) Draw a parallelogram, **ABCD**, with the side **AB** 3 inches long, side **BC** 2 inches long, and angle **ABC** = 40°.

(8) Draw a rhombus, **ABCD**, with the angle **ABC** = 75°.

(9) Draw a parallelogram, **PQRS**, with side **PQ** = 5 cms., side **QR** = 3 cms., and angle **PQR** = 50°.

(10) Draw a parallelogram, **ABCD**, with side **AB** = 2·5 ins., side **BC** = 1·7 ins., and angle **ABC** = 30°. Also draw a rectangle, **PQRS**, with side **PQ** = 2·5 ins., and side **QR** = 1·7 ins.

EXAMPLES 13 (b).

(1) Draw a straight line, **AB**, 1·8 inches long. On **AB** draw an equilateral triangle, **ABC**. Also on **AB**, but on the opposite sides of it, draw an isosceles triangle, **ABD**, with the sides **AD** and **BD** each 2·5 inches long. Is the figure **ACBD** a parallelogram?

(2) Draw a straight line, **AB**, 2·5 inches long. On **AB** draw two isosceles triangles, **ABC** and **ABD**, one on each side of **AB**. Make the sides of the triangle **ABC** 3 inches long, and those of the triangle **ABD** 4 inches long.

This figure is called a *Kite*.

(3) On a loose piece of paper draw a triangle, **ABC**. Draw a straight line, **DE**, across the triangle and parallel to **BC**. Cut out the figure **BCED**.

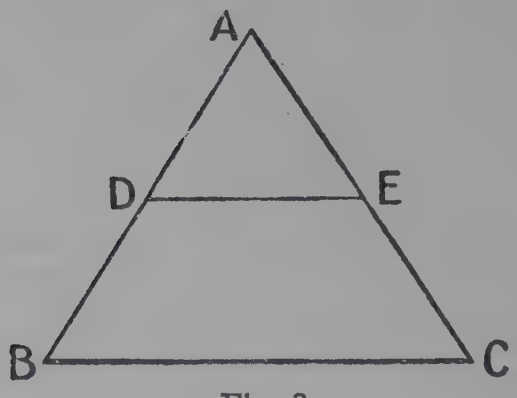

Fig. 8.

This four-sided figure, which has two sides parallel and two sides not parallel, is called a *Trapezoid*.

(4) On your drawing-paper, draw any triangle, **ABC**, with a line, **DE**, parallel to the base, as in the last question. Shade the part **BCED**. Is this figure **BCED** a parallelogram?

(5) Draw a triangle, **ABC**, having the angle at **B** a right angle.

Draw a line, **DE**, parallel to the base, **BC**, as in the last two questions. In what way is the figure **BCED** different from a parallelogram?

(6) Draw an equilateral triangle, **ABC**. Draw a line, **DE**, parallel to the base, **BC**, as in Fig. 8, thus making a Trapezoid, **BCED**.

(7) Draw two parallel lines, **AB** and **CD**, $1\frac{1}{2}$ inches apart. Make **AB** 2 inches long, and **CD** 3 inches long. Join the ends of **AB** and **CD** so as to make a trapezoid.

(8) Draw a trapezoid whose parallel sides are 2·5 inches and 3 inches long, and the perpendicular height 1·5 inches. Try to make two different trapezoids from these measurements.

(9) Draw a trapezoid as follows—Make **AB** 3 inches long. At **A** make the angle **BAC** = 60°, and make **AC** 2 inches long. Through **C** draw **CD** parallel to **AB**, and 1·5 inches long. Join **DB**, and measure it.

(10) Draw a trapezoid, **ABCD**, with **AB** parallel to **CD**. **AB** = 1·5 inches; **CD** = 2·5 inches. Angles at **A** and **D** = 90°, and **AD** = 1 inch. Measure the angles at **C** and **B**.

Enter in Note Book and learn :—

All four-sided figures are not parallelograms.

A *Trapezoid* is a four-sided figure with one pair of opposite sides parallel and the other pair not parallel.

EXAMPLES 14 (a).

(1) From $1\frac{3}{5}$ bushels take $\frac{2}{3}$ of a bushel.

(2) Add together $2\frac{4}{7}$ cwts. and $3\frac{1}{4}$ cwts.

(3) Find the difference between $12\frac{1}{6}$ lbs. and $8\frac{3}{4}$ lbs.

(4) Find the value of $£4\frac{1}{5} - £1\frac{2}{3}$.

(5) If $3\frac{5}{6}$ yards + $2\frac{4}{5}$ yards = **x** yards, what is the value of **x**?

(6) If $2\frac{1}{4}$ feet are cut from a rope which measures $4\frac{2}{5}$ feet, what is the length of the remaining piece?

(7) Add together $4\frac{1}{7}$ cwts. and $3\frac{3}{4}$ cwts.

(8) Take $3\frac{5}{9}$ from $5\frac{1}{2}$.

EXAMPLES 14 (b).

(1) A man spent $\frac{7}{8}$ of his money and had 2/4 left. How much had he at first?

(2) A typist wrote **56** letters in one day, and $\frac{7}{8}$ as many on the next day. How many did she write in the two days?

(3) Tom gave away $\frac{8}{15}$ of his marbles and had **56** left. How many had he at first?

(4) At a cricket match the losing side made **63** runs, which was $\frac{3}{5}$ of the number made by the winning side. By how many runs was the match won?

(5) I had £2. I spent $\frac{1}{3}$ of it and then $\frac{3}{8}$ of it. How much money had I left?

(6) From a length of wire measuring $16\frac{1}{4}$ yards long a piece measuring $7\frac{5}{8}$ yards is cut off. How long is the remaining piece?

(7) The surface of a river first rose $14\frac{1}{2}$ inches, and then fell $15\frac{5}{6}$ inches. How much lower is it than when first observed?

(8) I spent $\frac{1}{4}$ of my money and then $\frac{3}{5}$ of it. What fraction of my money had I left?

EXAMPLES 14 (c).

Work these multiplication sums, and check the answers by drawing straight lines of the proper length.

(1) $\frac{1}{2}$ of an inch × 7
(2) $\frac{1}{4}$ of an inch × 11
(3) $\frac{1}{10}$ of a decimetre × 9
(4) $\frac{3}{4}$ of an inch × 6
(5) $\frac{5}{8}$ of an inch × 8
(6) $\frac{9}{10}$ of a centimetre × 12
(7) $\frac{7}{12}$ of a foot × 8
(8) $\frac{3}{100}$ of a metre × 7
(9) $\frac{3}{8}$ of an inch × 22
(10) $\frac{4}{5}$ of a centimetre × 13

EXAMPLES 14 (d).

(1) Draw, on squared paper, a rectangle 3 inches long and $\frac{4}{5}$ of an inch wide. Find its area by arithmetic and check by counting squares.

(2) Draw, on squared paper, a rectangle $\frac{9}{10}$ of an inch in width and 4 inches in length. Find its area and check your answer by counting squares.

(3) Eight children had $\frac{2}{5}$ of a pound each. How much money had they altogether?

(4) Find in two different ways the cost of 7 pounds of cheese at $\frac{2}{3}$ of a shilling per pound.

(5) Find in two different ways the cost of 15 books at 2/6 each.

(6) A parcel weighs $\frac{2}{7}$ of a cwt. Find, in cwts., the weight of 12 such parcels.

(7) Multiply $\frac{5}{16}$ of a sovereign by 24.

(8) A jug holds $\frac{5}{6}$ of a pint. How many pints will be required to fill this jug 18 times?

EXAMPLES 14 (e).

On squared paper draw rectangles of the dimensions given below. Find their areas by arithmetic, and check your answers by counting squares.

(1) $2\frac{1}{2}$ ins. by 2 ins.
(2) $3\frac{1}{2}$ ins. by 3 ins.
(3) $3\frac{1}{4}$ ins. by 2 ins.
(4) $2\frac{3}{4}$ ins. by 2 ins.
(5) $4\frac{1}{5}$ ins. by 3 ins.
(6) 5 ins. by $2\frac{1}{2}$ ins.
(7) 6 ins. by $3\frac{2}{5}$ ins.
(8) $4\frac{7}{10}$ ins. by 3 ins.
(9) $5\frac{3}{4}$ ins. by 4 ins.
(10) $3\frac{3}{10}$ ins. by 3 ins.

EXAMPLES 14 (f).

(1) If it takes $3\frac{5}{8}$ yards of cloth to make a skirt, how many yards will be required to make 8 such skirts?

(2) Find in two different ways the cost of 12 yards of cloth at 3/7 per yard.

(3) What is the price of 9 yards of calico at the rate of $3\frac{5}{8}$ pence per yard?

(4) A jar holds exactly $1\frac{3}{4}$ pints. Another jar holds just 8 times as much. How many pints does the second jar hold?

(5) A cistern is filled by a pipe which gives $2\frac{5}{6}$ gallons every minute. How much water will flow into it in 9 minutes?

(6) A train travels a mile in $2\frac{7}{10}$ minutes. How many minutes will it take to travel 12 miles?

(7) The length of a man's pace is $1\frac{1}{12}$ yards. How many yards will he cover in taking 24 paces?

(8) If 14 books, each $1\frac{4}{5}$ inches thick, are placed one upon another, how high will the pile reach?

EXAMPLES 14 (g).

(1) Draw a straight line $\frac{1}{2}$ a yard in length. With compasses divide it into 4 equal parts. What is the length in yards of each part?

(2) Draw a straight line $\frac{3}{4}$ of a foot long, and divide it into 9 equal parts. How long, in feet, is each of these parts?

(3) Draw a straight line $\frac{5}{6}$ of a foot in length. Divide it into 2 equal parts. Find the length, as a fraction of a foot, of each part.

(4) Divide $\frac{3}{4}$ of a sovereign equally among 5 boys. What part of a sovereign will each boy get?

(5) If $\frac{4}{5}$ of a sovereign was paid for 6 books, what fraction of a sovereign was paid for each book?

(6) Five equal jugs contain altogether $\frac{5}{6}$ of a gallon of water. What part of a gallon does each jug contain?

(7) Divide $\frac{7}{10}$ of a metre by 2.

(8) If 14 equal packets of sweets together weigh $\frac{7}{8}$ of a pound, what part of a pound does each packet weigh?

EXAMPLES 14 (h).

(1) Draw a straight line $4\frac{4}{5}$ inches long. With compasses divide it into 4 equal parts. Measure the length of each part. Also find the length by arithmetic.

(2) Divide $3\frac{3}{4}$ inches by 10. Check your answer by drawing a straight line on squared paper.

(3) A piece of string measuring $6\frac{2}{3}$ feet in length is cut into 10 equal pieces. What is the length in feet of each piece?

(4) Divide £$1\frac{2}{5}$ equally among 7 people. What fraction of a pound will each person receive?

(5) If 14 books cost £$1\frac{1}{6}$, what was the price of each book (in pounds)?

(6) A motor-car travels 6 miles in $9\frac{3}{5}$ minutes. How long, on the average, does it take to travel a mile?

(7) If 12 bullets weigh together $10\frac{1}{2}$ ounces, what is the average weight in ounces of each bullet?

(8) If a man earns $8\frac{3}{4}$ shillings in 10 hours, what fraction of a shilling does he earn in an hour?

EXAMPLES 15 (a).

(1) A jar which holds $\frac{3}{4}$ of a gallon is three-quarters full. What fraction of a gallon does it contain?

(2) A boy lost $\frac{1}{4}$ of his money, and then spent $\frac{1}{3}$ of what he had left. What fraction of his money did he spend?

(3) A girl had $\frac{2}{3}$ of $\frac{3}{4}$ of a sovereign. What fraction of a sovereign had she?

(4) If I have $\frac{4}{5}$ of a sovereign, and give away $\frac{5}{6}$ of it, what fraction of a sovereign do I give away?

(5) A boy had $\frac{1}{2}$ a gallon of nuts. If he gave away $\frac{2}{3}$ of them, what fraction of a gallon did he give away?

(6) Find the price of $\frac{3}{4}$ of a lb. of steak at $\frac{5}{6}$ of a shilling per lb. Work this sum in two ways.

(7) A man owned $\frac{5}{6}$ of a ship, and sold $\frac{3}{4}$ of his share. What fraction of the ship did he sell?

(8) In an examination $\frac{7}{8}$ of the boys of a class passed, and $\frac{1}{3}$ of those who passed obtained a prize. What fraction of the whole class obtained a prize?

EXAMPLES 15 (b).

(1) What is the value of $\frac{1}{8}$ of $2\frac{1}{3}$ shillings?

(2) I had $3\frac{3}{4}$ pounds of tea, but have used $\frac{4}{5}$ of it. What weight have I used?

(3) A jar contains $4\frac{1}{2}$ gallons of water. If $\frac{5}{6}$ of this quantity are drawn off, how many gallons are drawn off?

(4) One parcel weighs $5\frac{3}{5}$ pounds. A second parcel weighs $\frac{3}{7}$ as much. What is the weight of the second parcel?

(5) A horse and cart are together worth £$32\frac{2}{3}$. If the horse is worth $\frac{5}{7}$ of this, what is its value?

(6) A vessel full of water weighs $6\frac{3}{4}$ pounds. The vessel itself

weighs $\frac{2}{9}$ of the total weight. What is the weight of the empty vessel?

(7) A man's working day is from 9.30 a.m. till 5 p.m., and he is allowed $\frac{1}{5}$ of this time for meals. How many hours is he allowed for meals?

(8) In a mixture of coffee and chicory, $\frac{3}{11}$ is chicory. How much chicory is there in $5\frac{1}{2}$ pounds of the mixture?

EXAMPLES 15 (c).

(1) Find, in two different ways, the price of $3\frac{3}{4}$ yards of ribbon at 1/3 per yard.

(2) How many miles will a man walk in $2\frac{3}{4}$ hours at the rate of $3\frac{1}{2}$ miles per hour?

(3) If a motor car goes a mile in $2\frac{3}{4}$ minutes, how many minutes will it take to go $5\frac{1}{2}$ miles?

(4) If a chest of tea contains $2\frac{1}{2}$ cwts., how much tea is contained in $4\frac{1}{2}$ chests?

(5) Find the cost of $2\frac{3}{8}$ yards of gold thread at 1/6 per yard.

(6) What is the cost in pence of $2\frac{3}{4}$ lbs. of bacon at $8\frac{1}{2}d.$ per lb.?

(7) The length of a room is $1\frac{3}{5}$ times as much as the breadth. If the breadth is $13\frac{3}{4}$ feet, what is the length?

(8) Multiply $3\frac{1}{5}$ inches by $2\frac{1}{2}$. Check your answer by making a drawing.

EXAMPLES 15 (d).

Find the areas of the rectangles whose dimensions are given in questions 1–5, and of the parallelograms whose bases and perpendicular heights are given in questions 6–10.

(1)	Rectangle.	Length	$4\frac{1}{2}$ ins.	Breadth	$2\frac{3}{4}$ ins.
(2)	,,	,,	$3\frac{1}{3}$ ft.	,,	$1\frac{4}{5}$ ft.
(3)	,,	,,	$3\frac{5}{6}$ yds.	,,	$2\frac{2}{5}$ yds.
(4)	,,	,,	$5\frac{1}{2}$ cms.	,,	$2\frac{7}{10}$ cms.
(5)	,,	,,	$3\frac{1}{10}$ metres.	,,	$2\frac{1}{2}$ metres.
(6)	Parallelogram.	Base	$7\frac{1}{2}$ ins.	Height	$1\frac{5}{6}$ ins.
(7)	,,	,,	$7\frac{1}{2}$ ft.	,,	$4\frac{1}{2}$ ft.
(8)	,,	,,	$3\frac{1}{3}$ yds.	,,	$2\frac{1}{10}$ yds.
(9)	,,	,,	$5\frac{3}{4}$ cms.	,,	$4\frac{4}{5}$ cms.
(10)	,,	,,	$3\frac{1}{8}$ ins.	,,	$2\frac{3}{10}$ ins.

EXAMPLES 15 (e).

(1) Find, in two ways, the area of a passage which is 10 ft. 8 ins. long, and 3 ft. wide.

(2) The top of a desk measures 4 ft. 7 inches in length, and 2 ft. in width. Find its area in two different ways.

(3) A piece of paper measures 12 inches by $6\frac{3}{4}$ inches. Find its area in square inches.

(4) A platform is 20 ft. long and $12\frac{3}{4}$ ft. wide. What is its area in square feet?

(5) A rectangle measures $3\frac{1}{2}$ ft. long and $2\frac{4}{5}$ ft. wide. What is its area?

(6) The length of a room is $4\frac{1}{6}$ yds., and its width $2\frac{1}{2}$ yards. What is its area in square yards?

(7) A rectangular garden plot is $6\frac{2}{3}$ yds. long and $2\frac{2}{5}$ yds. broad. Find the number of square yards in its area.

(8) The length of a parallelogram is 2 ft. 8 inches, and its perpendicular height 1 ft. 10 inches. Find its area.

EXAMPLES 16 (a).

(1) Draw on squared paper a parallelogram, ABCD. From the points A and B, draw perpendiculars to meet CD in E and F. By counting squares, find the areas of ABCD and ABEF.

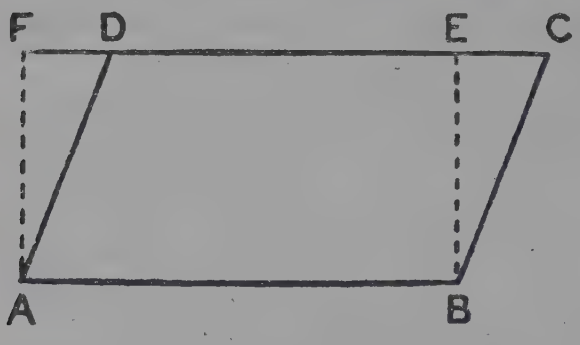

Fig. 9.

(2) On squared paper, draw two parallelograms with equal bases, and equal vertical heights. Find the area of each of them by counting squares.

(3) On squared paper, draw a parallelogram, ABCD. Without counting squares, find its area in two different ways.

Enter in Note Book, and learn:—

(*a*) Every parallelogram is equal to a rectangle having the same base, and the same vertical height.

(*b*) Parallelograms with equal bases and equal vertical heights are equal in area.

(*c*) The area of a parallelogram = b × h.

(4) On squared paper, draw a parallelogram, with sides 3 inches and 2 inches, and containing an angle of 60°. Draw and measure its perpendicular height, and find its area. Check the answer by counting squares.

(5) Draw, on squared paper, a parallelogram, with sides 3·2 and 2·4 inches, and containing an angle of 45°. Calculate its area, and check the answer by counting squares.

(6) A field is in the shape of a parallelogram. One of the sides measures 53 yards, and the perpendicular distance between this side and the one opposite to it is 37 yards. What is the area of the field?

EXAMPLES 16 (b).

Draw parallelograms from the measurements given below. In each case measure the vertical height and find the area, checking the answers by counting squares.

(1)	Sides 2·5 ins. and 3 ins.	Angle 60°
(2)	„ 3 ins. and 1·8 ins.	„ 75°
(3)	„ 2 ins. and 2·3 ins.	„ 105°
(4)	„ 1·6 ins. and 3·5 ins.	„ 30°
(5)	„ 6 cms. and 6 cms.	„ 60°
(6)	„ 5 cms. and 7 cms.	„ 120°

EXAMPLES 16 (c).

Find the areas of the parallelograms having the following dimensions—

(1)	Base 6 ins.	Height 11 ins.
(2)	„ 12·6 cms.	„ 6·5 cms.
(3)	„ 3·9 yds.	„ 2·7 yds.
(4)	„ 4·65 ins.	„ 7·4 ins.
(5)	„ $3\frac{1}{2}$ ins.	„ $2\frac{1}{4}$ ins.
(6)	„ $3\frac{5}{8}$ ins.	„ $2\frac{1}{2}$ ins.
(7)	„ 2 ft. 9 ins.	„ 3 ft. 6 ins.
(8)	„ 3 ft. 4 ins.	„ 2 ft. 8 ins.
(9)	„ 4 ft.	„ 1 ft. 7 ins.
(10)	„ x cms.	„ y cms.

EXAMPLES 17 (a).

(1) Convert to farthings—

£7 13*s.* $6\frac{1}{2}$*d.* and £8·345.

(2) Express 5368 farthings as pounds and decimals of a pound.

(3) A man paid £6 15*s.* 8*d.* for a quantity of tobacco. If he paid at the rate of 4*d.* an ounce, how many ounces did he buy? How many pounds?

(4) If the price of tea is 1/8 per pound, how many pounds may be bought for £12 15*s.* 0*d.*?

(5) Find, in two different ways, the cost of 56 pounds of butter at 1/3 per pound.

(6) A quantity of cheese was sold for £4 4*s.* 0*d.* If the price was at the rate of 9*d.* a pound, how many pounds were sold?

(7) How many fourpences are worth as much as 102 half-crowns?

(8) How many yards of calico at $6\frac{1}{2}$*d.* per yard can be bought for £2 12*s.* $3\frac{1}{4}$*d*?

EXAMPLES 17 (b).

(1) A dealer bought a horse for 27 guineas. After keeping it for 7 weeks, he sold it for £35 12*s.* 6*d.* If the cost of keeping the horse amount to 7/6 per week, how much profit did the dealer make?

(2) The materials for a sideboard cost £8 13*s.* $8\frac{1}{2}$*d.*, and the wages of the workman who made it were £2 13*s.* 6*d.* It was sold at a profit of £2 16*s.* $3\frac{1}{2}$*d.* What was the selling price?

(3) A farmer went to market with £50 in his pocket. He bought a cow for £12 15*s.* 0*d.*, a horse for 23 guineas, and 5 sheep at £1 13*s.* 4*d.* each. How much money had he left?

(4) From the sum of £68 13*s.* $4\frac{1}{2}d.$, £45 18*s.* 9*d.*, and £123 12*s.* $10\frac{3}{4}d.$ take £97 13*s.* $4\frac{1}{2}d.$

(5) To the difference between £105 16*s.* 8*d.* and £78 18*s.* $10\frac{1}{2}d.$ add £95 12*s.* $6\frac{3}{4}d.$

(6) A man has to pay two bills—one for £12 18*s.* 9*d.*, and the other £27 13*s.* 6*d.* He has only £36 17*s.* 6*d.* How much more does he require?

(7) What is left out of £100 after paying away the following amounts: £12 16*s.* $8\frac{1}{2}d.$, £25 14*s.* $10\frac{3}{4}d.$, and £37 8*s.* $6\frac{1}{2}d$?

(8) By how much does the sum of £136 18*s.* 9*d.*, £47 13*s.* 6*d.*, and £218 10*s.* $9\frac{1}{2}d.$ fall short of £500?

Worked Examples.

Divide £57 13*s.* $3\frac{1}{2}d.$ by 6, 24, and 23.

(*a*)

	£	*s.*	*d.*
6)	57	13	3·5
	9	12	2·58

(*b*)

	£	*s.*	*d.*
24 (4)	57	13	3·5
(6)	14	8	3·87
	2	8	0·64

(*c*)

	£	*s.*	*d.*	£
23)	57	13	3·5	(2
	46			
	11			
	20			
23)	233	(10*s.*		
	230			
	3			
	12			
23)	39·5	(1·71*d.*		
	23			
	165			
	161			
	40			
	23			

£2 10*s.* 1·71*d.*

EXAMPLES 17 (c).

Divide—

(1)	£30 2*s.* 4*d.* by 26	(7)	£199 0*s.* $8\frac{1}{2}d.$ by 13
(2)	£39 4*s.* $0\frac{1}{2}d.$,, 31	(8)	£288 9*s.* 0*d.* ,, 27
(3)	£61 18*s.* 2*d.* ,, 38	(9)	£486 4*s.* $4\frac{1}{2}d.$,, 15
(4)	£114 13*s.* 4*d.* ,, 43	(10)	£40 1*s.* 0*d.* ,, 48
(5)	£76 14*s.* $3\frac{1}{2}d.$,, 23	(11)	£86 14*s.* 8*d.* ,, 52
(6)	£206 19*s.* 6*d.* ,, 17	(12)	£511 12*s.* 9*d.* ,, 67

Prove the first ten questions by multiplication.

EXAMPLES 17 (d).

(1) A shepherd bought 27 sheep at £1 11*s.* 6*d.* each. Six of them died, and he then sold the remainder at £2 3*s.* 4*d.* each. How much did he gain?

(2) Find the difference between the cost of 23 yards of silk at 6/7$\frac{1}{2}$ per yard, and 23 yards of velvet at 5/9 per yard.

(3) A man's wages for 43 weeks amounted to £89 4*s.* 6*d.* How much did he earn per week?

(4) The total sum received at a sale of horses was £612 19*s.* 0*d.* The number of horses sold was 26. What was the average price obtained for each horse?

(5) How much is left out of £300 after 17 persons have received £12 17*s.* 6*d.* each?

(6) A roll of cloth containing 53 yards was sold for £12 9*s.* 6$\frac{1}{2}$*d.* What was the price per yard?

(7) A farmer sold a flock of 67 sheep at the average price of £1 16*s.* 4*d.* each. What was the total amount he received for them?

(8) A man receives £1 18*s.* 0*d.* as wages for one week. If he works 6 days in the week, and 8 hours per day, how much does he earn per hour?

(9) A farmer bought 5 cows and 36 sheep for £109 5*s.* 0*d.* He paid £13 15*s.* 0*d.* for each cow. What was the price of each sheep?

(10) What is the price of 75 articles at 16/3 per dozen?

EXAMPLES 17 (e).

Make out bills for the following—

(1) 8$\frac{1}{2}$ lbs. of salmon at 1/8 per lb.; 11 lbs. of cod at 6$\frac{1}{2}$*d.* a pound; 5 dozen oysters at 3/9 per score.

(2) 9$\frac{1}{2}$ lbs. of mutton at 11*d.* a pound; fore quarter of lamb, 12$\frac{1}{4}$ lbs., at 1/- per lb.; 7 lbs. steak at 11$\frac{1}{2}$*d.* per lb.; 12$\frac{1}{2}$ lbs. of beef at 9$\frac{1}{2}$*d.* per lb.

(3) 6 pairs of gloves at 1/11$\frac{1}{2}$ per pair; 8 dozen buttons at 3$\frac{1}{2}$*d.* per dozen; 3 dozen yards of ribbon at 3$\frac{3}{4}$*d.* per yard; 15 yards of trimming at 1/6$\frac{1}{2}$ per yard.

(4) 1 doz. pairs of socks at 1/6$\frac{1}{2}$ per pair; 6 vests at 3/6$\frac{1}{2}$ each; 3 ties at 1/9$\frac{1}{2}$ each; half a dozen collars at 9/6 per dozen.

EXAMPLES 18 (a).

Reduce—

(1) 2 tons 7$\frac{1}{2}$ cwts. to stones.

(2) 12·56 chains to feet.

(3) 4 miles 7 furlongs to chains.

(4) 6 miles 5·6 furlongs to chains.

(5) 5 furlongs 7 chains to yards.

(6) 3 miles 5 furlongs 88 yards to yards.
(7) 7 furlongs 3 chains 35 links to links.
(8) 8·245 furlongs to links.
(9) 597 chains to miles and decimals of a mile.
(10) 348 stones to tons
(11) 6160 yards to miles and decimals of a mile.
(12) 6996 yards to miles, furlongs, and chains.

EXAMPLES 18 (b).

(1) How many nails, each $\frac{1}{2}$ an inch long, would reach a distance of 3 chains, if placed end to end?

(2) A road 2 miles 3 furlongs in length is to be fenced on both sides. How many yards of fencing will be required?

(3) I measured the length of a wall by counting the number of bricks. If each brick was 9 inches long, and there were 583 bricks in each row, how long was the wall?

(4) If a motor car travels at the rate of 650 yards per minute, how far (miles and yards) will it go in a quarter of an hour?

(5) If 1 ton 13 cwts. of tea were given away to a number of poor people, at the rate of 1 pound for each, how many people received gifts?

(6) If 3 miles 650 yards of paper were used, for a certain number of newspapers, each of which required 1 yard of the paper, how many newspapers were printed?

(7) If sound travels at the rate of 1120 feet per second, how far would the report of a cannon travel in 5 seconds?

(8) If I see the smoke from a gun 12 seconds before I hear its report, how far is the gun away from me—supposing that sound travels at the rate of 1120 feet per second?

EXAMPLES 18 (c).

(1) How many rails, each 30 feet long, will be required for a "single line" of railroad, $7\frac{1}{2}$ miles long?

(2) If each of a boy's steps measures 2 feet, how many steps will he take in walking a distance of $4\frac{1}{2}$ furlongs?

(3) How many sacks, each of which holds $\frac{1}{2}$ cwt., are required to carry 840 lbs. of flour?

(4) A wall measures 7·25 chains in length. What is its length in feet?

(5) A bicycle wheel measures $7\frac{1}{2}$ feet in circumference. How far does the bicycle travel while the wheel turns round 1000 times?

(6) A rectangular field is $5\frac{1}{2}$ chains long and $3\frac{1}{2}$ chains wide. How many hurdles, each 9 feet long, will be required to enclose it?

(7) A train left London at 10.35 in the morning, and reached Edinburgh at 7.15 in the evening. If $\frac{3}{4}$ of an hour were spent in stoppages, how many minutes did the journey from London to Edinburgh actually take?

(8) How much money will be received for 5 bushels of peas at 2*d.* per pint?

EXAMPLES 18 (d).

(1) A man started to walk a distance of 9 miles 7 furlongs, but when 3 miles 105 yards from his journey's end, he entered a tram-car and finished his journey riding. How far had he walked?

(2) One path measures 7 furlongs 100 yards in length, and another 57 chains 20 yards. What is the difference between their lengths?

(3) Find the total of these distances—

3 miles 2 furl. 4 chains; 1 mile 5 furl. 3 chains; and 6 miles 7 furlongs 2 chains.

(4) Add together—

5 tons 13 cwts. 3 qrs.; 3 tons 7 cwts. 1 qr.; 18 cwts. 2 qrs.; and 1 ton 12 cwts. 3 qrs.

(5) Find the difference between

7 cwts. 3 qrs. 8 lbs.; and 3 cwts. 2 qrs. 14 lbs.

(6) Find the perimeter of a four-sided field whose sides measure 1 furlong 1 chain, 9 chains 53 links, 1 furlong 3 chains 16 links, and 8 chains 75 links.

Worked Examples.

£	*s.*	*d.*	£
26) 76	13	2	(2
52			
24			
20			
26) 493	(18*s.*		
26			
233			
208			
25			
12			
26) 302	(11·6*d.*		
26			
42			
26			
160			
156			

£2 18*s.* 11·6*d.* *Ans.*

tons	cwts.	qrs.	tons
26) 76	13	2	(2
52			
24			
20			
26) 493	(18 cwts.		
26			
233			
208			
25			
4			
26) 102	(3·9 qrs.		
78			
240			
234			

2 tons 18 cwts. 3·9 qrs. *Ans.*

EXAMPLES 18 (e).

Work the following multiplication and division sums, and *prove* your answers—

(1) 3 tons 15 cwts. 1 qr. × 7
(2) 5 mls. 3 fur. 7 chains × 9
(3) 7 cwts. 2 stones 5 lbs. × 8
(4) 3 fur. 4 chains 25 links × 40

(5) 7 chains 15 yds. 2 ft. × 16
(6) 1 ton 16 cwts. 3 qrs. × 26
(7) 7 tons 1 cwt. 3 qrs. ÷ 9
(8) 17 fur. 9 chains 3 yds. ÷ 7
(9) 47 mls. 0 fur. 2 chains ÷ 12
(10) 33 mls. 6 fur. 120 yds. ÷ 24
(11) 30 cwts. 6 stones 7 lbs. ÷ 34
(12) 4 fur. 7 chs. 25 links ÷ 15

EXAMPLES 18 (f).

(1) If a wheel $8\frac{1}{2}$ feet in circumference turns round 44 times in a minute, how far will it travel in an hour?

(2) Find the total weight of an engine and 7 carriages, if the engine weighs 45 tons 7 cwts. 3 qrs., and each carriage 8 tons 12 cwts. 2 qrs.

(3) It requires 57 hurdles, each measuring 2 yds. 1 ft. 9 inches, to enclose a certain field. What is the perimeter of the field?

(4) A man works from 6.30 a.m. till 5.15 p.m. each day, taking 1 hour 30 minutes for his meals. How many hours, etc., does he actually work in 4 weeks of 6 days each?

(5) Two boys start to walk from the same place in the same direction, at 8 o'clock in the morning. The first walks at the rate of 88 yards per minute, and the second at the rate of 72 yards per minute. How many yards are they apart at a quarter to 12?

How many yards would they be apart at this time if they had walked in opposite directions?

(6) An empty bucket weighs $2\frac{3}{4}$ lbs. It is filled with $3\frac{1}{2}$ gallons of water. If a gallon of water weighs 10 lbs., what is the weight of the filled bucket?

(7) In walking a distance of 61 yds. 1 ft. 2 ins. a man took 65 steps. How long was each of his steps?

(8) A tram-road, 6 mi. 2 fur. 50 yds. in length, was constructed in 34 weeks. What was the average length of line constructed each week?

(9) There were 30 jars, each holding 3 galls. 3 qts. of wine. All this wine was put into 6 casks, an equal amount in each. Find how much wine was put into each cask.

(10) A cistern contains 56 galls. 2 qts. If water flows through the outlet pipe at the rate of 3 galls. 2 qts. every minute, how much water will be left in the cistern after the outlet pipe has been open 10 minutes?

EXAMPLES 18 (g).

(1) Find the price of 3 tons of potatoes at $8\frac{1}{2}d.$ per stone.

(2) Five pounds of tea at 1/9 per lb. were mixed with 12 pounds at 1/4 per lb. The mixture was sold at 1/8 per lb. What was the profit?

(3) After paying a bill at the coal merchant's, I had £3 8*s.* 9*d.* left out of a five-pound note. If the coal I paid for was 1/3 per cwt., what was the quantity of coal?

(4) What will it cost to paint a wall 55 feet long and 14 feet high, at the rate of $1\frac{1}{2}d.$ per square foot?

(5) Find the cost of fencing a rectangular field 12 chains long and $9\frac{1}{2}$ chains wide at 3/6 per yard.

(6) A grocer bought 2 cwts. of tea for £12 17*s.* 6*d.*, and sold it at 1/6 per lb. How much did he gain?

EXAMPLES 19 (a).

(1) If I have $\frac{7}{8}$ of a sovereign, to how many children can I give $\frac{1}{16}$ of a sovereign each?

(2) How many pounds of butter at £$\frac{1}{12}$ per pound can be obtained for £$\frac{7}{8}$?

(3) A rod $\frac{5}{6}$ of a yard long was cut into pieces measuring $\frac{1}{12}$ of a yard each. How many pieces were made?

(4) A jug holds exactly $\frac{1}{10}$ of a gallon. How many times can it be filled from a pail which holds $\frac{4}{5}$ of a gallon?

(5) How many weights, $\frac{1}{8}$ of an ounce each, are equal to a single weight of $\frac{3}{4}$ of a pound?

(6) If you have £$\frac{3}{4}$, how many books costing £$\frac{3}{16}$ each could you buy?

(7) Divide $\frac{5}{8}$ of a foot into parts each measuring $\frac{1}{12}$ of a foot. How many such parts are there? Make a drawing to prove your answer.

(8) How many ounces of tobacco at $\frac{3}{8}$ of a shilling per ounce can be bought for $\frac{15}{16}$ of a shilling?

EXAMPLES 19 (b).

(1) How many pieces of metal weighing $\frac{4}{5}$ of a pound each can be cut from a sheet of metal weighing $3\frac{1}{5}$ pounds?

(2) How many packages of $\frac{3}{8}$ of a pound each can be made up from a quantity weighing $4\frac{1}{2}$ pounds?

(3) How many bottles of medicine can be filled from $8\frac{1}{3}$ pints if each bottle holds $\frac{5}{6}$ of a pint?

(4) I cut a piece of string measuring $4\frac{1}{8}$ yards long into pieces each $\frac{3}{4}$ of a yard in length. How many pieces have I?

(5) A jar contains $7\frac{2}{9}$ gallons of oil. If $\frac{5}{9}$ of a gallon are used every day, how many days will the oil last?

(6) How many pounds of cheese at $\frac{2}{3}$ of a shilling per pound can be bought for $5\frac{1}{6}$ shillings?

(7) The length of a railing is $19\frac{4}{5}$ metres, and its height $\frac{9}{10}$ of a metre. How many times greater than the height is the length?

(8) How many books, each $\frac{11}{12}$ of an inch in thickness, can be placed side by side on a bookshelf measuring $38\frac{1}{2}$ inches in length?

(9) If $7\frac{1}{2}$ yards of cloth cost 40*s.*, what is the price of 1 yard?

(10) The product of two fractions is 22. One of the fractions is $3\frac{1}{7}$. What is the other?

EXAMPLES 19 (c).

(1) If a litre measures $1\frac{3}{4}$ pints, how many litres are there in 14 pints?

(2) A motor-car goes a mile in $3\frac{1}{2}$ minutes. How many miles does it travel in an hour at this rate?

(3) How many kilograms will there be in $3\frac{3}{10}$ pounds if one kilogram weighs $2\frac{1}{5}$ pounds?

(4) A man earns £420 in $3\frac{1}{2}$ years. How much does he earn per year?

(5) If $1\frac{3}{4}$ lbs. of flour are used to make a twopenny loaf, how many such loaves could be made from $24\frac{1}{2}$ lbs. of flour?

(6) A boy walks at the rate of $3\frac{3}{5}$ miles per hour. In how many hours will he cover a distance of $16\frac{1}{5}$ miles?

(7) If a boy's steps are each $2\frac{1}{4}$ feet long, how many steps will he take in walking a distance of $40\frac{1}{2}$ feet?

(8) How many yards of cloth at $1\frac{3}{8}$ shillings per yard can be bought for $8\frac{1}{4}$ shillings?

(9) A rod measures $5\frac{1}{2}$ yards in length. How many such rods, placed end to end, will reach a distance of $24\frac{3}{4}$ yards?

(10) A boy can finish a page of writing in $7\frac{1}{2}$ minutes. How many pages could he finish in 45 minutes at this rate?

EXAMPLES 20 (a).

(1) Find the perimeter of a parallelogram whose sides measure 36·25 and 27·68 cms. respectively.

(2) Add together $\frac{3}{10}$, $\frac{14}{100}$, and $\frac{108}{1000}$. Work the sum in two different ways.

(3) Find in two different ways the difference between $\frac{407}{1000}$ and $\frac{12}{100}$.

(4) Simplify 6·324 − 1·057 + 2·563.

(5) A truck and its load weigh together 13·285 tons. The truck itself weighs 4·096 tons. What is the weight of the load?

(6) The four sides of a field measure 37·38 yards, 65·25 yards, 57·12 yards, and 49·65 yards. What is the perimeter of the field in yards?

(7) From a roll of cloth 10 metres long, two pieces, measuring respectively 4 metres 75 centimetres, and 3 metres 35 centimetres, were cut off. Find the length of the remaining piece.

(8) The distance from A to B is 7·35 kilometres, from B to C 2·68 kilometres, and from C to D 3·57 kilometres. What is the distance from A to D?

EXAMPLES 20 (b).

(1) How many lbs. are equal to 23·7 stones?
(2) Express 3·28 cwts. as pounds.
(3) Reduce 3·58 miles to chains.
(4) A portion of tramway measures 7·45 furlongs in length. Give its length in yards.
(5) Express 324·4 chains as miles.
(6) How many quarters are equal to 362·6 lbs.?
(7) Express as bushels 536· quarts.
(8) Reduce 7·35 chains to feet.

EXAMPLES 20 (c).

(1) Find exactly the number of square feet of carpet required to completely cover a floor 15·25 feet long and 8·5 feet wide. Also give the answer to the nearest square foot.
(2) What is the exact area of a parallelogram whose base measures 4·5 inches and perpendicular height 3·25 inches?
(3) What is the product of (*a*) 3·215 and 78, (*b*) 3·16 and 2·7?
(4) If the length of a boy's step is 2·35 feet, what distance (in feet) does he cover in taking 76 steps?
(5) If £1 is equal in value to 20·47 German *marks*, how many marks are equal in value to £10·5?
(6) A parcel weighs 3·02 kilograms. Find the weight of 26 similar parcels.
(7) Find the cost of 3·75 yards at £4·6 per yard. Work this question in two different ways.
(8) If 1 mile = 1·6 kilometres, how many kilometres are equal to 3·75 miles?

EXAMPLES 20 (d).

(1) A piece of wire measuring 228 inches in length is cut into 16 equal pieces. How long is each piece?
(2) If 26 equal packages weigh 55·25 lbs., what is the weight, in lbs., of each package?
(3) In 72 hours a steamer travelled 700 miles. What was its average rate per hour?
(4) If 27 parcels weighed altogether 465 pounds, what was the average weight of each parcel?
(5) Find the eighteenth part of 42·3 tons.
(6) How many chains and decimals of a chain are equal to 80·96 yards?
(7) Express 37·5 lbs. as stones.
(8) In walking a distance of 72·2 yards a man took 76 steps. What was the average length (in yards) of each of his steps?

EXAMPLES 20 (e).

Work these division sums, and prove the answers by multiplication—

(1) 35·28 ÷ 8, 80, and ·8
(2) 5·896 ÷ 11, 1·1, and ·11
(3) 1·35 ÷ 15, 1·5, and ·15
(4) 5·325 ÷ 25, 2·5, and ·25

(5) 36 ÷ 6, ·6 and ·06
(6) 7·15 ÷ 55, 5·5, and ·55
(7) 8·74 ÷ 23, ·23, and ·0023
(8) ·0507 ÷ 3·9, ·39, and ·039
(9) 17·1 ÷ 7·6, ·76, and ·076
(10) 1·71 ÷ 7·6, ·76, and ·076
(11) 1·755 ÷ 6·5, ·65, and ·065
(12) ·0738 ÷ 8·2, ·82, and ·082

EXAMPLES 20 (f).

(1) Two numbers multiplied together make 20·57. One of the numbers is 3·4. Find the other.

(2) If $7{\cdot}9x = 19{\cdot}75$, find the value of x.

(3) Divide the sum of 0·185 and 1·075 by ·36.

(4) How many times can 0·75 lbs. be taken from 3·525 lbs?

(5) If 1 kilogram = 2·2 lbs., how many kilograms are equal to 8·25 lbs.?

(6) How many yards of silk at 7·5 shillings a yard can be bought for 24·375 shillings?

(7) How many pieces of ribbon, each 1·3 feet long, can be cut from a piece measuring 17 feet in length?

(8) How many times can a measure which holds 0·5 pints be filled from a vessel containing 7·38 pints?

(9) How many books, each 1·2 inches thick, can I place upon a shelf 43 inches long?

(10) If a mile is equal to 1·6 kilometres, how many miles are equal to 4·128 kilometres?

(11) If a railway can be constructed at the rate of 0·24 miles per day, how long will it take to construct 18 miles?

(12) When wood is burnt, every 1 lb. of wood produces 0·23 lbs. of ashes. How many lbs. of wood must be burnt to produce 57·5 lbs. of ashes?

Read these worked Examples carefully—

(*a*) The area of a rectangle is 195 square inches, and its length is 15 inches. What is its breadth?

Working.

Suppose that the breadth is x inches

Then $15x = 195$

$$\therefore \quad x = \frac{195}{15}$$

$$= 13$$

Answer 13 inches.

(*b*) The product of two numbers is 77·42; one of the numbers is 9·8. What is the other?

Working.

Suppose that x is the other number.

Then $9{\cdot}8 \times x = 77{\cdot}42$

$$\therefore \quad x = \frac{77{\cdot}42}{9{\cdot}8}$$

$$= 7{\cdot}9.$$

EXAMPLES 21 (a).

(1) Find the length of the rectangle whose area is 97·5 sq. inches, and whose breadth is 7·8 inches.

(2) The base of a parallelogram measures 8·5 inches, and its area is 76·5 square inches. Find its vertical height.

(3) What is the breadth of the rectangle whose length is 8·5 cms. and area 53·55 sq. cms.?

(4) The area of a parallelogram is 90·1 sq. cms., and one of its sides is 8·5 cms. Find its vertical height.

(5) The area of a parallelogram is 3 sq. feet, and one side measures 16 inches. Find its vertical height.

(6) The vertical height of a parallelogram is 2·5 ft., and its area is 9·375 sq. ft. Find the length of its base.

(7) The area of a rectangular passage is 15 sq. yards, and its length 27 feet. What is its breadth?

(8) It took 432 turfs, each measuring 2 sq. feet in area, to cover a lawn. The length of the lawn was 36 feet. What was its breadth?

EXAMPLES 21 (b).

(1) Two numbers multiplied together are equal to 8·97. If one of the numbers is 2·6, what is the other?

(2) The product of two numbers is $26\frac{7}{12}$. If one of the numbers is $7\frac{1}{3}$, what is the other?

(3) If a train is travelling at the rate of 35 miles per hour, how long will it take to go a distance of 253·75 miles?

(4) Find the value of x when $19x = 197{\cdot}6$.

(5) If $xy = 729$, find the value of y when $x = 27$.

(6) The sum of £24 13*s.* 6*d.* was shared equally among a certain number of people, so that each person received £1 3*s.* 6*d.* How many persons were there?

(7) Six tons of coke were placed in sacks, each sack holding 56 lbs. How many sacks were used?

(8) A circular bicycle track was 220 yards in circumference. How many times would a bicycle go round this track in a race of 5 miles?

PART III

EXAMPLES 22 (a).

(1) If $a = 9$ and $b = 3$, what is the value of

(i.) $a + b$ (ii.) $a - b$ (iii.) ab (iv.) $\frac{a}{b}$?

(2) Work Question 1 again, supposing that

(i.) $a = 16$ and $b = 4$ (ii.) $a = 25$ and $b = 5$

(iii.) $a = 72$ and $b = 8$ (iv.) $a = 192$ and $b = 12$

(3) When $a = 9$ and $b = 6$, find the values of

(i.) $4a + 4b$ (ii.) $4(a + b)$

(4) Work Question 3 again, supposing that
(i.) $a = 15$ and $b = 9$ (ii.) $a = 12$ and $b = 16$
(iii.) $a = 56$ and $b = 24$ (iv.) $a = 145$ and $b = 76$

(5) If $x = 10$ and $y = 5$, find the values of
(i.) $5x - 5y$ (ii.) $5(x - y)$

(6) Work Question 5 again, supposing that
(i.) $x = 15$ and $y = 8$ (ii.) $x = 24$ and $y = 18$
(iii.) $x = 45$ and $y = 27$ (iv.) $x = 125$ and $y = 81$

(7) When $x = 8$ and $y = 5$, find, in two different ways, the values of
(i.) $12x + 12y$ (ii.) $25(x + y)$
(iii.) $9x - 9y$ (iv.) $18(x - y)$

(8) Find in the shortest way the value of $23a + 23b$, and of $23a - 23b$, when $a = 27$ and $b = 13$.

EXAMPLES 22 (b).

(1) When $n = 12$, find the value of—
(i.) $7n + 8n$ (ii.) $n(7 + 8)$
(iii.) $14n + 25n$ (iv.) $n(14 + 25)$
(v.) $34n - 18n$ (vi.) $n(34 - 18)$
(vii.) $65n - 27n$ (viii.) $n(65 - 27)$

(2) If $a = 8$, what is the value of—
(i.) $3a + 4a + 5a$ (ii.) $a(3 + 4 + 5)$

(3) If $x = 4$, $y = 5$, and $z = 6$, find the values of—
(i.) $x + y + z$ (ii.) $x + y - z$
(iii.) $x - y + z$ (iv.) xyz

(4) When $x = 8$, $y = 9$, and $z = 10$, what is the value of—
(i.) $3x + 4y + 5z$ (ii.) $5x - 4y + 3z$
(iii.) $4x + 3y - 5z$ (iv.) $5y + 4z - 3x$

(5) If $a = 10$, $b = 5$, and $c = 0$, find the values of—
(i.) $a + b - c$ (ii.) $3a - 4b - 5c$
(iii.) $4a - 2b + 10c$ (iv.) $7a - 3b + 8c$

(6) Given that $x = 8$, $y = 6$, and $z = 0$, find the values of—
(i.) $2x + 3y - 4z$ (ii.) $4x - 3y + 2z$
(iii.) $x + 2y - 4z$ (iv.) $2x - y - 4z$

(7) When $a = 6$, $b = 7$, and $c = 8$, find the values of—
(i.) $ab + bc + ac$ (ii.) $ab - bc + ac$

(8) If $x = 9$ and $y = 7$, find the value of
$(3x + 2y) - (2x + 3y)$

EXAMPLES 23 (a).

(1) What is the difference between 3 bush. 0 pks. 1 gall. and 1 bush. 3 pks.?

(2) Two men started on a walking match. The first completed the distance in 7 hrs. 3 mins. 45 secs., and the second took 37 mins. 25 secs. longer than this. How long did the second man take?

(3) Add together these lengths: 3 miles 5 fur. 7 chains, 6 miles 7 fur., 8 fur. 4 chains, and 2 miles 3 fur. 4 chains.

(4) From the sum of 5 tons 13 cwts. 3 qrs., and 12 tons 17 cwts. 2 qrs., take 8 tons 15 cwts. 3 qrs.

(5) From a roll of wire containing **153** yds. **1** ft. **3** ins., two pieces measuring respectively **32** yds. **1** ft. **6** ins., and **72** yds. **2** ft. **3** ins. are cut off. Find the length of wire remaining.

(6) A rectangular park measures **7** fur. **3** chains in length, and **5** fur. **7** chains in breadth. Find its perimeter.

(7) A cart is loaded with **15** sacks. Each sack, when empty, weighs **6** lbs., and each contains **3** qrs. **16** lbs. of corn. What is the total weight on the cart?

(8) The weights of four men were **9** stone **8** lbs., **7** stone **10** lbs., **12** stone **5** lbs., and **11** stone **4** lbs. Find the average weight of the four men.

(9) A tank containing **75** gallons of water weighs **10** cwts. **1** qr. **14** lbs. If a gallon of water weighs **10** lbs., what would be the weight of the empty tank?

(10) A grocer mixed together **3** cwts. **2** qrs. **7** lbs. of coffee and **1** cwt. **3** qrs. **14** lbs. of chicory. He then made the mixture up into 7-lb. parcels. How many parcels were there?

EXAMPLES 23 (b).

(1) Multiply each of the following by **42** and by **37**—

(*a*) **£4 14***s.* **7**$\frac{1}{2}$*d.* (*d*) **3** tons **13** cwts. **3** qrs.
(*b*) **9** yds. **2** ft. **3** ins. (*e*) **6** miles **5** fur. **7** chains.
(*c*) **7** galls. **3** qts. **1** pt. (*f*) **13** cwts. **1** qr. **16** lbs.

(2) Divide each of the following by **36** and **43**, giving remainders as decimals—

(*a*) **£89 15***s.* **7***d.* (*d*) **52** tons **6** cwts. **1** qr.
(*b*) **113** yds. **1** ft. **6** ins. (*e*) **70** miles **3** fur. **6** chains.
(*c*) **201** galls. **3** qts. **1** pt. (*f*) **12** cwts. **3** qrs. **14** lbs.

(3) At each stroke a certain pump lifts **5** galls. **2** qts. **1** pt. of water. How much water will it lift in **29** strokes?

(4) How far does a cyclist ride in going **17** times round a circular racecourse which measures **5** fur. **7·3** chains?

(5) A steel bar weighs **1** cwt. **3** qrs. **8** lbs. What would be the weight of **25** such bars?

(6) A baker uses **8** sacks of flour, each containing **1** cwt. **3** qrs. **21** lbs. in **6** days. What weight of flour does he use per day?

(7) An army marches a distance of **87** miles **3** fur. **7** chains in **5** days. What is the average distance covered per day?

(8) A cistern containing **115** galls. **3** qts. of water is emptied in **26** minutes. What quantity of water flows out of the cistern per minute?

(9) Express as yards—

(*a*) **36** poles. (*b*) **8**$\frac{1}{2}$ poles. (*c*) **15** poles **2** yds.
(*d*) **3** fur. **13** poles. (*e*) **2** miles **3** fur. **14** poles.

(10) How many poles are equal to **147** yards?

(11) A farmer uses a half-rod stick to measure the length of a field. He finds that the length of the field is **48** times that of his stick. What is the length of the field—

(*a*) in poles? (*b*) in yards? (*c*) in chains?

(12) I measure the distance between two telegraph posts by the side of a railway, and find them to be just 77 yds. apart. Then I notice that a passing train takes just 7 seconds in going from one of these posts to the other. At what rate is the train travelling (miles per hour)?

EXAMPLES 23 (c).

(1) A ball of string contains 25 yds. 2 ft. How many pieces, each measuring 1 ft. 10 ins. in length, can be cut from it?

(2) The circumference of a cart-wheel is 8 ft. How far will it go in turning 324 times?

(3) If the circumference of a bicycle wheel is 8 ft. 3 ins., how often will it revolve in going a distance of 500 yds.?

(4) How many parcels, each weighing 2 lbs. 8 ozs., will make up a total weight of 1 cwt. 3 qrs. 14 lbs.?

(5) How many hurdles, each 7 ft. 6 ins. long, will be required to make a rectangular sheepfold 37 yds. 1 ft. 6 ins. long, and 25 yds. wide?

(6) Each of Tom's steps measures 2 ft. 3 ins., and each of Harry's 1 ft. 9 ins. How many more steps will Harry take than Tom in walking a distance of half a mile?

(7) If a bucket holds 3 galls. 1 pt., how many times can it be filled from a barrel holding $37\frac{1}{2}$ galls.?

(8) If, on a certain day, the sun rises at 5.48 a.m., and sets at 6.50 p.m., how long is it above the horizon?

(9) If telegraph poles are put up at equal distances of 66 yds. apart, how many poles will be used in a distance of 3 miles? (Remember that the number of poles will be one more than the number of "spaces.")

(10) A farm labourer measures the length of a field with a half-rod measuring stick. He finds that the length is 4 chains. How many times did he use the stick?

(11) If 5 of a man's paces = 1 pole, how many paces will he take in walking a distance of 0·9 furlongs?

(12) A machine is at work from 9.30 a.m. till 12 noon, and from 1 till 5 p.m. each day. If it makes 40 articles in an hour, how many will it make in a day?

EXAMPLES 23 (d).

(1) A man works 8 hrs. a day on 6 days a week. Find his total wages for 26 weeks, at the rate of $10\frac{1}{2}d.$ an hour.

(2) What is the cost of $7\frac{1}{2}$ cwts. of potatoes at $1/3\frac{1}{2}$ per stone?

(3) Find the cost of 6 barrels of oil, each containing 9 gallons, at $10\frac{1}{2}d.$ per quart.

(4) Find the cost of 3 fur. 4 chains of fencing at 6/3 per yard.

(5) A grocer bought 56 lbs. of tea and 2 cwts. of coffee for 17 guineas. The coffee cost £7 per cwt. What was the price of the tea per lb.?

(6) A grocer bought 5 cwts. of sugar for £7. If 10 lbs. were wasted and the rest sold at $3\frac{1}{2}d.$ per lb., what was the profit?

(7) Make out a bill for: 3 stones of flour, at $4\frac{1}{2}d.$ per lb.; 2 sacks of meal, each $1\frac{1}{2}$ cwts., at $10\frac{1}{2}d.$ per stone; 70 cakes, at 14 for 1/-.

(8) Make out a bill for: 3 cwts. of apples, at 1/3 per stone; 18 gallons of cider, at $6\frac{1}{2}d.$ per pint; 56 lbs. of pears, at $2\frac{1}{2}d.$ per lb.

EXAMPLES 23 (e).

(1) Reduce—

(i.) 35 sq. yards to sq. feet (ii.) 16 sq. ft. to sq. inches
(iii.) 216 sq. ft. to sq. yards (iv.) 847 sq. inches to sq. feet

(2) Convert—

(i.) 15 acres to sq. chains (ii.) 635 sq. chains to acres
(iii.) 4 sq. chains to sq. yards (iv.) 2 acres to sq. yards

(3) Four cricket stumps are set up at the corners of a square, 22 yards along each side. Find the area of the square—(i.) in sq. yards, (ii.) in square chains, (iii.) in acres.

(4) On your squared paper let 1 inch represent 22 yards. Draw a rectangle to represent 1 acre.

(5) An acre of ground is rectangular in shape, and 22 yards wide. How long is it?

(6) Express as decimals of an acre—

1 sq. chain, 2 sq. chains, 3 sq. chains,
4, 5, 6, 7, 8, 9, and 10 sq. chains

(7) Express the following areas as decimals of an acre—

(i.) 3 acres 5 sq. chains (ii.) 12 acres 3 sq. chains
(iii.) 15 acres $2\frac{1}{2}$ sq. chains (iv.) 21 acres 7·5 sq. chains

(8) On squared paper draw a square $5\frac{1}{2}$ inches each side. Suppose this square represents a square chain. Divide it up, by cross lines, into parts, each of which represents a square rod.

EXAMPLES 23 (f).

(1) A small farm consists of 4 fields, whose areas are 3 acres 5 sq. chains; 6 acres 2 sq. chains; 4 acres 7 sq. chains; and 5 acres 8 sq. chains. Find the total area of the farm.

(2) A piece of land containing 2 acres 3 sq. chains was purchased, and a school built upon it. If the school buildings covered $6\frac{1}{2}$ sq. chains, what was the area of the playground?

(3) From a field containing 10 acres 2 sq. chains, a piece measuring 2 acres 7 sq. chains was fenced off. What was the area of the remainder?

(4) A farm consisted of 75 acres 8 sq. chains of pasture land, 50 acres 4 sq. chains of arable land, and the farmyard and buildings covered 1 acre 2 sq. chains. What was the total area of the farm?

(5) An estate containing 512 acres was cut up into three portions. The area of the first portion was 116 acres 5 sq. chains, and of the second portion 240 acres 8 sq. chains. What was the area of the third portion?

(6) In a field of 7 acres 3 sq. chains, a farmer constructed a sheepfold whose area was $1\frac{1}{2}$ acres. What was the area of the remaining part of the field?

EXAMPLES 23 (g).

(1) Find the area, in acres, of the fields whose dimensions are given below—

(i.) 5 chains × 4 chains (ii.) 13 chains × 9 chains
(iii.) 7·5 chains × 4·6 chains (iv.) 3·2 chains × 0·85 chains
(v.) $3\frac{1}{4}$ chains × $2\frac{1}{2}$ chains (vi.) $4\frac{1}{2}$ chains × $2\frac{7}{10}$ chains

(2) A farmer measured a rectangular field with a half-rod stick. He found that the length was 28 rods, and the breadth 26 rods. What was the area of the field—

(*a*) in sq. rods? (*b*) in sq. chains? (*c*) in acres?

(3) In the school garden there are 20 plots, and each plot has an area of 4 square rods. What is the total area of the school garden—

(*a*) in sq. rods? (*b*) in sq. chains? (*c*) in acres?

(4) A field of 15 acres was divided up into equal allotments. Each allotment covered an area of 8 square rods. How many allotments were there?

(5) Find the rent of a field 12 chains long and 7·8 chains wide, at £2 10*s.* 0*d.* per acre.

(6) A field, 9 chains in length and $5\frac{1}{2}$ chains in breadth, was sold for £495. What was the price per acre?

(7) Find the cost of a field measuring 13·5 chains by 8·3 chains at £36 per acre.

(8) Find the cost of making up a road 11 yards wide and 220 yards long at the rate of £248 per acre.

EXAMPLES 23 (h).

(1) Find the area, in square inches, of the rectangles whose dimensions are given below. Convert the square inches to square centimetres by multiplying by 6·45. Check your answers by drawing, upon centimetre paper, rectangles of the given dimensions and counting squares.

(i.) 3 ins. × 4 ins. (ii.) 2 ins. × 5 ins.
(iii.) 1·6 ins. × 5 ins. (iv.) 2·5 ins. × 6 ins.
(v.) 3 ins. × 2·6 ins. (vi.) 2·4 ins. × 2·5 ins.

(2) Find the area in square centimetres of the rectangles whose dimensions are given below—

(i.) 12 ins. × 15 ins. (ii.) 8·5 ins. × 16 ins.
(iii.) 16·2 ins. × 10 ins. (iv.) 24 ins. × 3·5 ins.
(v.) 6·4 ins. × 1·5 ins. (vi.) 7·5 ins. × 3·2 ins.

(3) The length of a rectangle, ABCD, is 8 inches, and its breadth 5 inches. What is its area in square inches? What is its length in centimetres? What is its breadth in centimetres?

(4) Using the answers obtained in question (3), find, in two different ways, the area of ABCD in square centimetres.

EXAMPLES 24 (a).

(1) Draw any triangle, **ABC**. On a sheet of tracing-paper mark a point, **O**. At the point **O**, copy each of the three angles of the triangle, **ABC**, so that they together form one angle. What do you notice about the size of this combined angle?

(2) Repeat Ex. 1, but in this instance, copy the three angles upon a sheet of ordinary paper, using ruler and compasses.

(3) Draw any triangle, **PQR**. Measure with the protractor each of the three angles of this triangle. Write down the value of the three angles, and add them together.

(4) Draw a fresh triangle, **ABC**, of different shape, and repeat Ex. 3.

(5) If **A**, **B**, and **C** are the angles of a triangle—

(*a*) Find the value of **A**, when **B** = 25°, and **C** = 75°.
(*b*) Find the value of **A** + **B**, when **C** = 70°.
(*c*) Find the value of **A**, when **B** and **C** each = 54°.
(*d*) Find the value of **A**, when **A** = **B** + **C**.
(*e*) Find the value of **C**, when **A** = 100° and **B** = **C**.
(*f*) Find the value of **A**, **B**, and **C** when they are all equal to one another.

Work each of these by arithmetic and check your answer by drawing.

Enter in Note Book, and learn:

The three interior angles of any triangle are together equal to 180°.

(6) Draw an isosceles triangle, **ABC**, with the equal sides **AB** and **AC**. Measure with the protractor the angles at **B** and **C**.

(7) Repeat Ex. 6 with another isosceles triangle of different size.

(8) Draw an isosceles triangle, **ABC**, with base **BC** = 1·5 inches, and the sides each = 3 inches. Measure the angles at **B** and **C**.

(9) Draw a square, **ABCD**, with sides 1·4 inches in length. Bisect the side **AB** in the point **E**. Join **EC**, **ED**. Measure the sides and angles of the triangle so formed. What kind of a triangle is it?

(10) Draw a straight line, **AB**, 2 inches long. At **A** make an angle **BAC** = 50°, and at **B** an angle **ABC** = 50°. Measure the lengths of **CA** and **CB**. What is the figure **CAB**?

(11) In the following questions, let **ABC** be an isosceles triangle, the angle at **C** being equal to the angle at **B**—

(*a*) Find the value of the angle **A**, when **B** = 40°.
(*b*) Find the value of the angle **A**, when **C** = 60°.
(*c*) Find the value of the angle **A**, when **B** + **C** = 150°.
(*d*) Find the value of the angle **B**, when **A** = 40°.

(*e*) Find the value of the angle **C**, when $\mathbf{A} = 70°$.

(*f*) Find the value of the angles **A**, **B**, and **C**, when $\mathbf{B} + \mathbf{C} = 110°$.

Work each question by arithmetic, and check your answer by making a drawing.

Enter in Note Book, and learn:

In an isosceles triangle, the angles which are opposite to the equal sides are equal to one another.

EXAMPLES 24 (b).

(1) Draw an equilateral triangle, **ABC**. Copy on tracing paper the angle at **A**, and place the tracing upon the other two angles in turn.

(2) Draw an equilateral triangle with sides **1·5** inches in length. Measure its angles with the protractor. What do you notice?

(3) Draw an equilateral triangle with sides **5** cms. in length. Measure its angles with the protractor.

Enter in Note Book, and learn:

The angles of an equilateral triangle are equal to one another. The value of each angle is **60°**.

(4) Draw an equilateral triangle, **ABC**, with each side **2** inches long. Bisect the angle at **A** by the straight line **AD** meeting the base at **D**. Measure the lengths of **BD** and **CD**. Also bisect the other angles in a similar way, and in each case measure the parts of the opposite side.

(5) Draw an equilateral triangle, **PQR**, with each side **4** cms. in length. Find the middle point of the side **QR**, and call it **S**. Join **PS**. Compare with tracing paper the two parts of the angle at **P**. Repeat this for each of the other sides.

(6) Draw an equilateral triangle, **ABC**, with each side **1·5** inches long. Repeat Ex. 16 with this triangle; but in this case measure all the angles with the protractor.

(7) Draw an equilateral triangle, **XYZ**. Join the point **X** to the middle point of the side **YZ**. Compare the angles of the triangles thus formed with those of a **60°** set square.

(8) Draw a triangle, **ABC**, with the side $\mathbf{AB} = 2''$, $\mathbf{BC} = 1{\cdot}5''$, and $\mathbf{CA} = 2{\cdot}5''$. Measure with the protractor the angles at **A**, **B**, and **C**, and write down the measurements.

(9) Draw any triangle, **PQR**, with sides of unequal length. Measure carefully all the sides and angles, and write down the measurements.

(10) Draw a straight line, **AB**, **2** inches long. At **A** make the angle $\mathbf{BAC} = 80°$, and at **B** the angle $\mathbf{ABC} = 20°$, so as to make a triangle **ABC**. Measure the lengths of the sides **CA** and **CB**.

Read the following carefully—

2/- or 1 florin = $\frac{1}{10}$ of £1 = £0·1.

1/- = $\frac{1}{2}$ of 2/- = $\frac{1}{2}$ of £0·1 = £0·05.

6*d.* = $\frac{1}{2}$ of 1/- = $\frac{1}{2}$ of £0·05 = £0·025.

Therefore we can write down, as decimals of £1, any sum of money consisting only of shillings and a sixpence.

Examples:

8/- = 4 florins = £0·4.

9/- = 4 florins + 1 shilling = £0·4 + £0·05 = £0·45.

9/6 = 4 fl. + 1 sh. + 1 sixpence = £0·4 + £0·05 + £0·025 = £0·475.

£3 9*s.* 6*d.* = £3·475.

Also, we can read off some decimals of a pound, as pounds, shillings, and sixpences.

Examples:

£0·6 = 6 florins = 12*s.* 0*d.*

£0·65 = £0·6 + £0·05 = 12*s.* 0*d.* + 1*s.* 0*d.* = 13*s.* 0*d.*

£0·625 = £0·6 + £0·025 = 12*s.* 0*d.* + 6*d.* = 12*s.* 6*d.*

£0·675 = £0·6 + £0·05 + £0·025 = 12*s.* 0*d.* + 1*s.* 0*d.* + 6*d.* = 13*s.* 6*d.*

EXAMPLES 25 (a).

(1) Write down each of the following sums of money as the decimal of a pound—

(*a*) 18/-	(*d*) 9/-	(*g*) 14/6	(*j*) 13/6
(*b*) £2 16*s.* 0*d.*	(*e*) £3 15*s.* 0*d.*	(*h*) £3 12*s.* 6*d.*	(*k*) £7 3*s.* 6*d.*
(*c*) 5/-	(*f*) £4 17*s.* 0*d.*	(*i*) 15/6	(*l*) £9 19*s.* 6*d.*

(2) Write down the following decimals in the ordinary way as sums of money—

(*a*) £0·8	(*d*) £0·35	(*g*) £0·525	(*j*) £0·875
(*b*) £3·4	(*e*) £5·25	(*h*) £2·625	(*k*) £4·175
(*c*) £0·75	(*f*) £6·95	(*i*) £0·375	(*l*) £18·775

Work each of the following exercises in the ordinary way. Then convert each of the sums of money into decimals of a pound, and work again in decimals. Compare the answers.

(3) Add together: £14 3*s.* 6*d.*, £8 17*s.* 6*d.*, £17 2*s.* 6*d.*, and £5 11*s.* 6*d.*

(4) Find the difference between £3 13*s.* 6*d.* and £7 8*s.* 0*d.*

(5) Multiply £5 15*s.* 6*d.* by 9, 25, and 34.

(6) Divide £60 7*s.* 6*d.* by 7, and by 35.

(7) Find the cost of 23 tons of coal at £1 6*s.* 6*d.* per ton.

(8) A man's wages amount to £2 13*s.* 6*d.* per week. How much does he earn in a year?

[NOTE:—In the remaining Examples 25, questions which are marked thus (*) are to be worked in two different ways—as ordinary money sums, and as decimals.]

EXAMPLES 25 (b).

(1) At a concert the doorkeeper received 17*s.* 9*d.* in pennies, £3 12*s.* 6*d.* in sixpences, £4 5*s.* 0*d.* in shillings, and £1 17*s.* 6*d.* in half-crowns. How many coins did he receive altogether?

(*2) If a man earns 2 guineas a week and spends £1 18*s.* 6*d.*, in how many weeks will he save £3 3*s.* 0*d.*?

(3) A workman earns 6/3 a day. In how many days will he earn £4 13*s.* 9*d.*?

(4) Every week a person spends £1 16*s.* 8*d.* At this rate, how long will £22 last him?

(*5) A person spent £25 4*s.* 0*d.* on pictures, which are sold at $1\frac{1}{2}$ guineas each. How many pictures did he buy?

(*6) How many books at 4/6 each can be bought for £11 18*s.* 6*d.*?

(*7) £55 2*s.* 6*d.* was paid in wages to a certain number of men. Each man received 17/6. How many men were there?

(8) How many times can an amount of 12/9 be paid out of £29 19*s.* 3*d.*?

(9) A certain quantity of cloth cost £12 19*s.* 0*d.* If the price was $4/7\frac{1}{2}$ a yard, how many yards were bought?

(10) If an Indian coin called a Rupee is worth 1/4, how many rupees are equal in value to £13 16*s.* 4*d.*?

EXAMPLES 25 (c).

(1) If 96 boxes of oranges cost £88 4*s.* 0*d.*, what is the price of one box?

(2) The sum of £30 12*s.* 6*d.* was divided amongst 47 men. Two of the men received 17/6 each, and the rest of the money was equally shared among the other 45 men. What sum did each of these receive?

(*3) A farmer bought a horse and 12 sheep for £41 9*s.* 6*d.* The horse cost £18 7*s.* 6*d.* What was the price of each sheep?

(4) A fishmonger bought 100 fish for 12/6. He sold $\frac{3}{5}$ of them at 2*d.* each, $\frac{1}{4}$ of them at 3*d.* each, and the rest at $1\frac{1}{2}$*d.* each. How much did he gain?

(5) A grocer bought 15 cheeses at £1 7*s.* $10\frac{1}{2}$*d.* each, and 13 at $16/4\frac{1}{2}$ each. He sold them all for £37 10*s.* 0*d.* What was his profit?

(*6) A man went to market, and sold 3 cows at 15 guineas each, and 14 sheep at £1 12*s.* 6*d.* each. He then bought a horse for 28 guineas. How much money had he left?

(7) Multiply each of the following by 32, and by 47—

(*a*) £3 16*s.* $2\frac{1}{2}$*d.* (**c*) £7 13*s.* 6*d.*

(*b*) £4 12*s.* $10\frac{3}{4}$*d.* (**d*) £5 11*s.* 6*d.*

(8) Divide each of the following by 35 and by 53, giving the remainders as decimals—

(*a*) £62 14*s.* 10*d.* (*c*) £134 13*s.* $6\frac{1}{2}$*d.*

(*b*) £116 12*s.* 7*d.* (*d*) £46 18*s.* $9\frac{3}{4}$*d.*

EXAMPLES 25 (d).

(*1) A man's income is £780 a year, and he spends on an average £10 13*s.* 6*d.* a week. How much does he save in a year?

(*2) A farmer sold 3 horses at £18 10*s.* 0*d.* each. With the money he bought a pony and 24 sheep. The pony cost £7 11*s.* 0*d.* What was the price of each sheep?

(*3) In a certain club 36 members pay 17*s.* 6*d.* each, and 45 members pay 10/6 each. What is the total amount of the subscriptions?

(*4) If my rent and taxes amount to £38 12*s.* 6*d.* per year, and my other expenses to £3 1*s.* 6*d.* per week, what are my total expenses for the year?

(*5) Find the cost of 27 books at £0·55 each.

(*6) What must be paid for 34 sheep at £2·95 each?

(7) Add together the sum and difference of £38 18*s.* $6\frac{3}{4}d.$ and £72 5*s.* $4\frac{1}{2}d.$

(8) A dealer bought half a gross of knives for £6 12*s* 0*d.*, and sold them at the average rate of $2/4\frac{1}{2}$ each. What was his profit?

EXAMPLES 26 (a).

(1) Measure very carefully the lengths of the straight lines AB and CD, and write down the lengths in inches and centimetres.

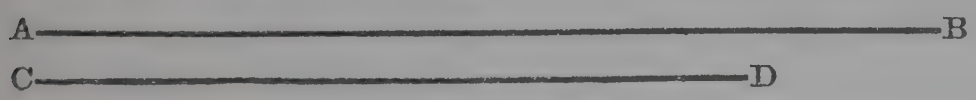

Fig. 10.

(2) Draw a straight line $XY = \frac{7}{8}$ of AB, and a straight line $WZ = \frac{4}{5}$ of CD.

(3) Construct a square, having its sides equal in length to XY. Find the area of this square in square inches, and in square centimetres.

(4) Draw a rectangle, PQRS, having its sides equal in length to XY and WZ. Find the perimeter in inches and centimetres of PQRS.

(5) Find in square inches and in square centimetres the area of PQRS (ques. 4).

(6) Draw the diagonal, PR, of the rectangle PQRS. Measure its length in inches. Convert the inches to centimetres, and check your answer by measuring.

(7) Draw an isosceles triangle, having its base = CD and its equal sides each = AB. Find the perimeter of this triangle in inches and in centimetres.

(8) Draw a parallelogram, having its base = AB and its height = CD. Find the area of this parallelogram in square inches and in square centimetres.

EXAMPLES 26 (b).

(1) Draw a rectangle, **ABCD**, with the dimensions given in Fig. 11.

(2) Calculate the area of **ABCD** in square inches.

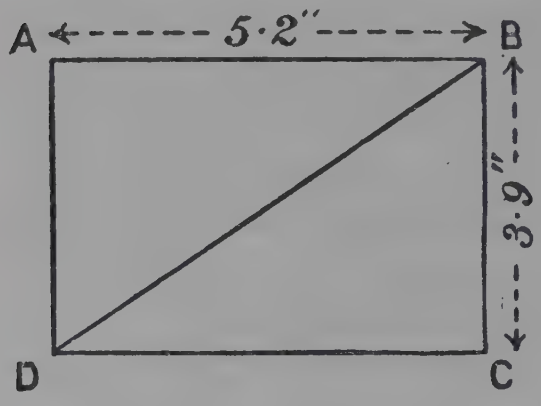

Fig. 11.

(3) Measure the length of the sides in centimetres, and calculate the area in square centimetres.

(4) Multiply the answer to No. 2 by **6·45**. Compare this result with the answer to No. 3.

(5) Draw another rectangle, **PQRS**, whose length, **PQ**, shall be $\frac{9}{13}$ of **AB**, and whose breadth, **QR**, shall be $\frac{9}{13}$ of **BC**.

(6) Find the area of **PQRS** in square inches.

(7) Measure the sides of **PQRS** in centimetres, and find the area in square centimetres.

(8) Check the answers to Nos. 6 and 7 as in No. 4.

(9) Draw a straight line, **XY**, equal to $\frac{4}{5}$ of **BD**. On **XY** construct a square. Calculate the area of this square.

(10) Find the area of this square in square centimetres. Check the answer as before.

(11) What would be the total area of **500** brass plates of the same size as **ABCD**?

(12) Calculate the cost of these brass plates at the rate of **1/9** per square foot.

EXAMPLES 26 (c).

(1) A tramway which measured **15·87** kilometres was lengthened to **23·25** kilometres. What length of tramway was added?

(2) From a roll of cloth, **25** metres long, three pieces measuring **4·75** metres, **5·16** metres, and **8·5** metres, respectively, were cut off. How much was left?

(3) Four boys measure a line whose true length is **15·25** cms. Their results are, **15** cms., **15·5** cms., **15·13** cms., and **15·75** cms. Find the average of their measurements. By how much does this average differ from the true length?

(4) Find the total weight in kilograms of **4** parcels weighing **3·68** kms., **14·25** kms., **27·08** kilograms, and **9·36** kms. respectively.

(5) A dealer bought **6** chairs at **£0·75** each, a couch for **£2·65**, and a table for **£3·45**. What change had he left out of **£20**? Work this in two different ways.

(6) Find the total weight of a train consisting of an engine and **9** trucks, if the engine weighs **60·37** tons, and each truck **13·15** tons.

(7) From the measurements given in Fig. 12, calculate the length of BC.

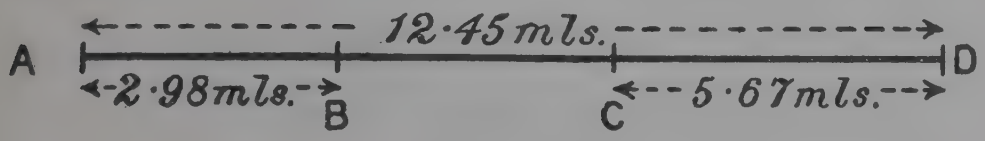

Fig. 12.

(8) If $23{\cdot}25 - (6{\cdot}87 + 3{\cdot}46) = x$, what is the value of x?

EXAMPLES 26 (d).

(1) Find the value, in pounds and decimals of a pound, of 47 articles, at £3·56 each.

(2) A field is 21·4 metres wide and 32·5 metres long. Find its area in square metres.

(3) If 1 mile = 1·61 kilometres, how many kilometres are there in 5·5 miles?

(4) Find the value, in pounds and decimals of a pound, of 5·48 kilograms of tobacco at 10·5 shillings per kilogram.

(5) How many inches are equal to 1·09 yards?

(6) If 1 metre = 39·37 inches, how many inches are there in 2·5 metres?

(7) If a train is travelling at the rate of 34·15 miles per hour, how many miles will it cover in 4·8 hours?

(8) If £1 = 24·75 francs (a French coin), how many francs are equal in value to £6 8*s*.?

EXAMPLES 26 (e).

(1) Find the breadth of a rectangle whose area is 9·01 sq. metres, and whose length is 3·4 metres.

(2) If 4·6 tons of coal cost £6·21, what is the price per ton?

(3) If 38·34 metres of ribbon are cut into a number of pieces, each 1·42 metres in length, how many pieces will there be?

(4) If each of a man's steps measures 0·95 yards, how many steps will he take in walking a distance of 0·5 miles?

(5) If a cyclist rides at the rate of 8·5 miles an hour, in how many hours will he cover a distance of 31·79 miles?

(6) Find the height of a parallelogram, whose base measures 3·8 inches, and whose area is 15·15 square inches.

(7) The product of two numbers is 21·66. One of the numbers is 7·6. Find the other number.

(8) Find the value of x, when

$$x = \frac{14{\cdot}75 + 12{\cdot}85}{4{\cdot}8}$$

EXAMPLES 26 (f).

(1) When $a = 7{\cdot}35$ and $b = 3{\cdot}76$, find the value of—

(i.) $a + b$ (ii.) $a - b$ (iii.) $2a - 3b$

(2) Repeat Ques. 1, when $a = 5{\cdot}62$ and $b = 2{\cdot}45$.

(3) If $p = 3{\cdot}25$, $q = 2{\cdot}75$, and $r = 1{\cdot}68$, find the value of—

(i.) $p + q + r$ (iii.) $p - q + r$

(ii.) $p + q - r$ (iv.) $3(r + q - p)$

(4) When $x = 1{\cdot}68$ and $y = 2{\cdot}45$, find the value of—

(i.) $4x + y$ (iii.) $3x - y$

(ii.) $x + 4y$ (iv.) $5x - 2y$

(5) Find the value of ab,

(i.) When $a = 1{\cdot}68$ and $b = 3{\cdot}5$

(ii.) When $a = 4{\cdot}3$ and $b = 2{\cdot}35$

(6) Find, correct to three decimal places, the value of $\frac{a}{b}$,

(i.) When $a = 4{\cdot}5$ and $b = 12$

(ii.) When $a = 0{\cdot}33$ and $b = 1{\cdot}6$

EXAMPLES 27.

(1) Draw a triangle, **ABC**, with sides **AB** = 1″, **BC** = 1·5″, **CA** = 2″. Draw a second triangle, **DEF**, with sides **DE** = 1″, **EF** = 1·5″, and **FD** = 2″. Copy the triangle **ABC** on tracing paper, and apply the tracing to the triangle **DEF**.

(2) Draw two triangles, **ABC** and **DEF**, so that the sides of each of them are 3 cms., 4 cms., and 5 cms. Measure with your protractor the angles of each of these triangles. Write down the measurements and compare them.

(3) Draw two triangles, each having sides 2″, 2·5″, and 3″ in length. What can you say about these two triangles? Prove with tracing paper that your statement is true.

(4) Draw two triangles, each having sides 1·5″, 2″, and 2·5″ long. Mark the angles of these triangles which are equal to one another. Prove that you have marked them correctly by measuring them with your protractor.

(5) Without measuring, draw any triangle you like. Now draw another triangle, exactly like the first.

(6) Draw two triangles, **ABC**, **DEF**, making **AB** and **DE** each 2″ long, **BC** and **EF** each 3″ long, and the angles **ABC** and **DEF** each 60°. Copy the triangle **ABC** on tracing paper, and apply the tracing to the triangle **DEF**. What do you notice?

(7) Draw two triangles, **ABC** and **DEF**, making **BC** and **EF** each 5 cms. long, **AC** and **DF** each 4 cms. long, and the angles **ACB** and **DFE** each 45°. Measure and compare the lengths of **AB** and **DE**.

(8) With your protractor, measure the following angles of the triangle of Ex. 7, and compare your measurements: **ABC** and **DEF**; **BAC** and **EDF**.

(9) Draw two triangles, **PQR** and **XYZ**, making **PQ** and **XY** each 2·5″ in length, **PR** and **XZ** each 3·2″ in length, and the angles **QPR** and **YXZ** each 30°. What can you say about the sides **QR** and **YZ**? Measure to see if you are right.

(10) In the triangles of Ex. 9, what can you say of the angles at **Q** and **Y**, and of the angles at **R** and **Z**? Test your answer by measuring the angles with your protractor.

(11) Draw any triangle you like, and call it **ABC**. Carefully measure the sides **AB** and **BC**, and the angle **ABC**. Using only these measurements, draw another triangle exactly equal to the triangle **ABC**. Test your drawing by using tracing paper.

(12) Draw two triangles, **ABC** and **DEF**, making **BC** and **EF** each 2·5″ long, the angles **ABC** and **DEF** each 60°, and the angles **ACB** and **DFE** each 45°. Compare these two triangles by using tracing paper.

(13) Draw two triangles, **PQR** and **XYZ**, making **QR** and **YZ** each 5 cms., the angles **PQR** and **XYZ** each 70°, and the angles **PRQ** and **XZY** each 30°. Measure and compare the sides **PQ** and **XY**, and the sides **PR** and **XZ**.

(14) Draw two triangles, **ABC** and **DEF**. Make **AC** and **DF** each 3 inches long, the angles **BAC** and **EDF** each 40°, and the angles **ACB** and **DFE** each 50°. Point out which of the sides are equal. Prove your answer by measuring.

(15) Draw any triangle you like and call it **ABC**. Carefully measure one of its sides and two of its angles, and write the measurements down. Using only these measurements, draw another triangle exactly equal to **ABC**.

Enter in Note Book, and learn:

Triangles which are equal in all respects are called *Congruent* triangles.

Two triangles are congruent when they have –

(*a*) The three sides of one of them equal to the corresponding sides of the other.

(*b*) Two sides and the contained angle of one of them, equal to two sides and the contained angle of the other.

(*c*) One side and two angles of one of them equal to one side and the two corresponding angles of the other.

EXAMPLES 28 (a).

(1) Express as decimals—

(*a*) $\frac{1}{8}$ (*b*) $\frac{3}{4}$ (*c*) $\frac{7}{20}$ (*d*) $\frac{4}{25}$ (*e*) $3\frac{5}{8}$ (*f*) $2\frac{3}{16}$ (*g*) $4\frac{11}{25}$ (*h*) $5\frac{9}{20}$

(2) Express as decimals, correct to the second place—

(*a*) $\frac{5}{9}$ (*b*) $\frac{4}{15}$ (*c*) $\frac{1}{24}$ (*d*) $\frac{3}{32}$ (*e*) $2\frac{7}{12}$ (*f*) $3\frac{2}{3}$ (*g*) $5\frac{4}{7}$ (*h*) $2\frac{5}{11}$

(3) Convert these decimals to vulgar fractions, and reduce to lowest terms—

(*a*) 0·35 (*b*) 2·64 (*c*) 1·16 (*d*) 3·95
(*e*) 0·875 (*f*) 2·175 (*g*) 1·256 (*h*) 2·128

(4) Find, by converting to decimals, which is the greatest of the following fractions—

$\frac{7}{8}$, $\frac{4}{5}$, $\frac{13}{20}$, $\frac{9}{16}$.

(5) Convert the following fractions to decimals, and add together the greatest and the least. Give the answer as a Vulgar Fraction.

$\frac{3}{5}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{20}$.

(6) Work the following questions in Vulgar Fractions. Check your answers by converting the fractions to decimals, and working decimally.

(*a*) $\frac{1}{2}+\frac{3}{5}$ (*b*) $2\frac{4}{5}-1\frac{3}{4}$ (*c*) $\frac{3}{5}+\frac{5}{8}-\frac{1}{2}$ (*d*) $1\frac{7}{8}-2\frac{3}{5}+1\frac{1}{4}$

EXAMPLES 28 (b).

(1) Find the sum of—

(*a*) $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ (*b*) $\frac{1}{5}$, $\frac{1}{6}$, and $\frac{1}{15}$

(*c*) $\frac{2}{3}$, $\frac{5}{12}$, and $\frac{3}{8}$ (*d*) $\frac{1}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$

(2) From the sum of £$\frac{5}{12}$ and £$\frac{1}{3}$ take £$\frac{1}{4}$. Work this sum in two different ways.

(3) Simplify $\frac{2}{3}+\frac{4}{5}-\frac{5}{6}$.

(4) A grocer sold $\frac{1}{3}$ of a cheese on Monday, $\frac{2}{7}$ of it on Tuesday, and $\frac{4}{21}$ on Wednesday. What fraction of the cheese did he sell in the three days?

(5) A man had three sons. To the first he left $\frac{1}{3}$ of his property, to the second $\frac{7}{15}$, and the remaining part to the third. What fraction of the property was left to the third son?

(6) Add together $\frac{2}{5}$ of a ton, $\frac{1}{3}$ of a ton, and $\frac{7}{15}$ of a ton.

(7) If $\frac{4}{9}+\frac{2}{3}-\frac{5}{12}=x$, what is the value of x?

(8) Find the difference between $\frac{3}{4}$ and $(\frac{1}{2}+\frac{1}{7})$.

EXAMPLES 28 (c).

(1) In an orchard $\frac{1}{2}$ of the trees are apple trees, $\frac{1}{3}$ are plum trees, and the rest pear trees. There are 10 pear trees. How many trees are there altogether?

(2) Two men were mowing a field. In one day the first man mowed $\frac{1}{5}$ and the second $\frac{2}{7}$ of the field. What part of the field remained unmown?

(3) I had 28 days' holiday. $\frac{3}{7}$ of the time I spent at the seaside, $\frac{1}{4}$ of the time on a cycle tour, and the rest of the time at home. How many days did I spend at home?

(4) A boy had 96 marbles. He gave away $\frac{1}{6}$ of them, and lost $\frac{1}{4}$ of them. How many had he left?

(5) In a journey of 24 miles, a man went $\frac{3}{4}$ of the distance by train, $\frac{1}{12}$ by tram, and walked the rest. How far did he walk?

(6) I spent $\frac{1}{4}$ of my money, and then $\frac{3}{5}$ of it. What fraction of my money had I left?

(7) Tom gave $\frac{1}{5}$ of his marbles to Harry, and $\frac{1}{3}$ of them to John. What fraction of his marbles did he keep for himself?

(8) A boy gave away to his brother $\frac{1}{7}$ of his marbles, and to his cousin $\frac{1}{3}$ of them. He then had 66 left. How many had he at first?

EXAMPLES 28 (d).

(1) Find the sum of $4\frac{1}{2}$, $3\frac{1}{3}$, and $2\frac{1}{5}$.

(2) From the sum of $3\frac{1}{6}$ and $5\frac{1}{5}$ take $4\frac{1}{3}$.

(3) Three lines measure respectively $3\frac{1}{3}$ inches, $5\frac{1}{4}$ inches, and $4\frac{3}{8}$ inches. Find their total length.

(4) A man walked for $2\frac{1}{2}$ hours, rested $\frac{3}{4}$ of an hour, and then cycled for $1\frac{1}{4}$ hours. How many hours did he spend altogether?

(5) Three parcels weigh respectively $2\frac{3}{4}$ pounds, $\frac{7}{8}$ of a pound, and $1\frac{5}{12}$ pounds. What is their total weight?

(6) The lengths of the sides of a triangle are $1\frac{3}{8}$ inches, $3\frac{1}{2}$ inches, and $2\frac{2}{3}$ inches. What is the perimeter of the triangle?

(7) The perimeter of an isosceles triangle is $7\frac{1}{12}$ inches. Each of the equal sides measures $2\frac{3}{8}$ inches. What is the length of the base?

(8) Simplify $1\frac{1}{3} + 2\frac{5}{8} - \frac{7}{12}$.

EXAMPLES 28 (e).

(1) $2\frac{3}{5}$ metres + $\frac{3}{4}$ of a metre + $1\frac{3}{10}$ metres = x metres. What is the value of x?

(2) How many ounces are equal to

$$3\tfrac{1}{3} \text{ ounces} + 2\tfrac{5}{6} \text{ ounces} - 1\tfrac{3}{4} \text{ ounces}?$$

(3) Find the difference between ($2\frac{1}{3}$ yards + $1\frac{1}{5}$ yards) and ($3\frac{1}{6}$ yards + $\frac{4}{5}$ of a yard).

(4) From a rod $8\frac{3}{8}$ inches long, a piece $3\frac{1}{3}$ inches is cut off. If $\frac{1}{12}$ of an inch is wasted in the cutting, find the length of the remainder.

(5) Three men, A, B, and C, own a ship. A owns $\frac{1}{6}$ of it, and B $\frac{2}{5}$ of it. What part of it does C own?

(6) A man goes $\frac{2}{3}$ of a journey by train, $\frac{1}{4}$ by tram, and the remainder, $2\frac{1}{2}$ miles, on foot. Calculate the whole distance.

(7) The sides of a triangle measure $4\frac{1}{2}$ inches, $3\frac{5}{6}$ inches, and $2\frac{1}{5}$ inches. Find its perimeter.

(8) Find the difference between ($1\frac{1}{5}$ feet + $2\frac{1}{3}$ feet) and ($4\frac{1}{2}$ feet − $2\frac{5}{6}$ feet).

EXAMPLES 29 (a).

(1) How many square inches are in a rectangular surface $5\frac{1}{5}$ inches wide and $6\frac{1}{2}$ inches long?

(2) What is the area of a pane of glass which measures $8\frac{1}{3}$ inches by $6\frac{3}{5}$ inches?

(3) How many square feet are there in a passage $3\frac{1}{2}$ ft. wide and $12\frac{3}{4}$ ft. long?

(4) Find in square ft. the area of a wall measuring $16\frac{1}{4}$ ft. in length, and $5\frac{3}{5}$ ft. in height.

(5) The length of a room is 15 ft. 4 ins., and the breadth 12 ft. 9 ins. Find the area of the floor in square feet.

(6) How many square feet of planking are needed for a floor 12 ft. 8 ins. long and 8 ft. 6 ins. wide?

(7) Out of a piece of paper $7\frac{3}{4}$ ins. square, I cut a rectangle $4\frac{1}{2}$ ins. $\times$ $3\frac{1}{2}$ ins. How many square inches of paper are left?

(8) Find the area of a parallelogram whose base measures $5\frac{3}{4}$ inches and whose perpendicular height is $3\frac{7}{8}$ inches.

EXAMPLES 29 (b).

(1) A jar which holds $2\frac{1}{9}$ gallons is $\frac{3}{7}$ full. What fraction of a gallon does it contain?

(2) If I have £$3\frac{1}{5}$ and give away $\frac{1}{4}$ of it, how much do I keep?

(3) A girl had $\frac{2}{3}$ of $\frac{3}{4}$ of half a crown. If she spent $\frac{1}{2}$ of her money, what part of half a crown had she left?

(4) A boy lost $\frac{1}{4}$ of his money and spent $\frac{1}{6}$ of the remainder. What part of his money had he left?

(5) From a piece of cloth measuring 30 yards in length, 9 pieces, each measuring $2\frac{3}{4}$ yards, were cut off. What was the length of the remaining piece of cloth?

(6) A tank is fed by two pipes. The one supplies $2\frac{3}{4}$ gallons a minute and the other $1\frac{4}{5}$ gallons a minute. How many gallons will the tank contain after $7\frac{1}{2}$ minutes?

(7) A line, AB, measures $3\frac{1}{8}$ inches in length. The length of another line, CD, is $1\frac{3}{5}$ times that of AB. Find the length of CD.

(8) Find the cost (in shillings) of $6\frac{3}{4}$ yards of cloth at $3\frac{5}{6}$ shillings per yard.

EXAMPLES 29 (c).

(1) The area of a rectangle is $8\frac{1}{8}$ sq. inches, and its length $3\frac{1}{4}$ inches. Find its breadth.

(2) The breadth of a rectangular sheet of paper is $7\frac{3}{10}$ centimetres, and its area $80\frac{3}{10}$ square centimetres. Find its length.

(3) A room is $21\frac{1}{3}$ feet long, and its area is 352 square feet. How wide is it?

(4) The area of a parallelogram is $16\frac{4}{5}$ square inches, and the length of its base $5\frac{1}{4}$ inches. What is its perpendicular height?

(5) 14 square yards of planking are used in making a platform, $5\frac{1}{3}$ yards long. How wide is the platform?

(6) The area of a rectangular lawn is $131\frac{1}{4}$ square yards, and it is $10\frac{1}{2}$ yards wide. How long is it?

(7) The area of a passage is 13 square yards, and its breadth $1\frac{1}{3}$ yards. What is its length?

(8) In paving a courtyard, the total area of the stone slabs used was $34\frac{5}{6}$ square yards. If the courtyard was $9\frac{1}{2}$ yards long, how wide was it?

EXAMPLES 29 (d).

(1) A motor-car goes a mile in $2\frac{1}{2}$ minutes. How many miles will it go in an hour?

(2) If a litre is equal to $1\frac{3}{4}$ pints, how many litres are equal to 28 pints?

(3) If a kilogram is equal to $2\frac{1}{5}$ pounds, how many kilograms are equal to 22 pounds?

(4) If $4\frac{3}{4}$ yards of cloth are required to make one suit of clothes, how many such suits can be made from a roll of cloth measuring 38 yards?

(5) A barrel contains 21 gallons of oil. If $1\frac{1}{6}$ gallons are used every day, in how many days will the barrel be empty?

(6) The area of a rectangle is $16\frac{3}{20}$ square inches, and its length is $4\frac{3}{4}$ inches. Find its breadth.

(7) The base of a parallelogram measures $5\frac{2}{5}$ cms., and its area is $15\frac{3}{25}$ square cms. What is its perpendicular height?

(8) How many steps, each $2\frac{1}{4}$ feet long, will a boy take in walking along a garden path whose length is $93\frac{3}{4}$ feet?

EXAMPLES 29 (e).

(1) Find the value of—

(*a*) $\frac{1}{12}$ of £1
(*b*) $\frac{1}{6}$ of a guinea
(*c*) $\frac{3}{4}$ of a mile
(*d*) $\frac{4}{5}$ of a ton
(*e*) $\frac{7}{8}$ of a cwt.
(*f*) $\frac{5}{7}$ of a stone
(*g*) $\frac{3}{16}$ of £1
(*h*) $\frac{5}{24}$ of 1/-

(2) Find the value of—

(*a*) $\frac{1}{3}$ of £8 16*s.* 3*d.*
(*b*) $\frac{1}{8}$ of 7 tons 15 cwts.
(*c*) $\frac{3}{7}$ of 3 cwts. 1 qr. 7 lbs.
(*d*) $\frac{4}{5}$ of 1 mile 3 fur. 5 poles
(*e*) $\frac{5}{6}$ of 7 yds. 2 ft. 9 ins.
(*f*) $\frac{7}{8}$ of £14 10*s.* 0*d.*
(*g*) $\frac{5}{16}$ of 7 stones 12 lbs.
(*h*) $\frac{4}{15}$ of £73 16*s.* 10*d.*

(3) Multiply—

(*a*) £6 5*s.* 7*d.* by $4\frac{1}{2}$
(*b*) £1 12*s.* $5\frac{1}{4}$*d.* by $7\frac{1}{9}$
(*c*) 3*s.* $6\frac{1}{2}$*d.* by $7\frac{3}{5}$
(*d*) £18 3*s.* 6*d.* by $12\frac{5}{8}$
(*e*) 4 mls. 0 fur. 10 po. by $6\frac{1}{10}$
(*f*) 6 cwts. 2 qrs. 14 lbs. by $5\frac{1}{7}$
(*g*) 9 yds. 1 ft. 6 ins. by $8\frac{5}{6}$
(*h*) 5 tons 12 cwts. 3 qrs. by $9\frac{4}{5}$

(4) Find the price of $18\frac{3}{4}$ lbs. of meat at 1/2 per lb.

(5) What will be the cost of $7\frac{3}{4}$ yds. of cloth at 3/6 per yard?

(6) What must be paid for $5\frac{1}{4}$ tons of coal at £1 7*s.* 6*d.* per ton?

(7) Find the cost of $8\frac{5}{6}$ yds. of material at 4/9 per yard.

(8) What change shall I receive out of a five-pound note after paying for $7\frac{1}{2}$ yards of silk at $5/11\frac{1}{2}$ per yard?

EXAMPLES 29 (f).

(1) If $a = \frac{3}{5}$ and $b = \frac{2}{3}$, find the value of—

(i.) $a + b$ (ii.) $b - a$

(2) Work Question 1 again, supposing that $a = 1\frac{3}{4}$ and $b = 2\frac{1}{2}$.

(3) When $x = \frac{1}{2}$, $y = \frac{2}{3}$, and $z = \frac{3}{5}$, find the value of—

(i.) $x + y + z$ (ii.) $x + y - z$

(iii.) $x - y + z$ (iv.) $z + y - x$

(4) Work Question 3 again, supposing that

$x = 1\frac{1}{3}$, $y = 1\frac{1}{4}$, and $z = \frac{5}{6}$

(5) Find the value of ab—

(i.) When $a = \frac{3}{8}$ and $b = \frac{2}{3}$

(ii.) When $a = 2\frac{1}{5}$ and $b = \frac{7}{11}$

(6) Find the value of $\frac{m}{n}$,

(i.) When $m = \frac{5}{8}$ and $n = \frac{5}{6}$

(ii.) When $m = 3\frac{1}{7}$ and $n = 1\frac{2}{9}$

EXAMPLES 30 (a). (Revision.)

(1) Find the area of a rectangle whose length is 2 ft. 9 ins., and breadth 1 ft. 8 ins.

(2) The length of a rectangular passage is 5 yds. 2 ft., and its breadth 1 yd. 1 ft. Find its area.

(3) The area of the surface of the lid of a box is $9\frac{3}{8}$ square feet, and its length is $3\frac{3}{4}$ feet. What is its breadth?

(4) How many square yards of carpet will be required to cover the floor of a rectangular hall whose length is 45 feet, and breadth $37\frac{1}{2}$ feet?

(5) What is the area of a parallelogram whose base measures 3·5 metres, and perpendicular height 1·75 metres?

(6) How many square feet of timber will be required to make a platform 9 yards long and $6\frac{1}{2}$ yards wide?

(7) The leaves of a book measure 14 inches by 8 inches each. If the book contains 96 leaves, how many square feet of paper does it contain?

(8) The area of a parallelogram is 14·625 sq. cms., and its height is 4·5 cms. What is the length of its base?

EXAMPLES 30 (b).

(1) The area of a rectangle is 16·45 sq. inches, and its length 4·7 inches. Find its breadth.

(2) The breadth of a rectangle is 4·8 cms., and its area 30·24 sq. cms. Find its length.

(3) If the area of a parallelogram is 20·8 sq. inches, and its vertical height 3·2, find the length of its base.

(4) The length of the base of a parallelogram is 7·3 cms., and its area 32·85 sq. cms. Find its perpendicular height.

(5) Find the length of a rectangle whose area is 29·61 sq. feet, and whose breadth is 4·7 feet.

(6) Find the perpendicular height of a parallelogram whose base measures 4·9 feet, and whose area is 28·42 square feet.

(7) The length of a rectangular room is 12·5 feet, and its area is 117·5 sq. ft. Find its breadth.

(8) The surface of a wall contains 54·05 square feet, and its length is 9·4 feet. What is its height?

EXAMPLES 30 (c).

(1) A schoolroom is 20 yards long and 22 ft. wide. How many children will this room accommodate at the rate of 10 sq. feet per child?

(2) How many square tiles, measuring 6 inches each way, will be required to cover a hearth 4 ft. 6 ins. long and 1 ft. 6 ins. wide?

(3) How many turfs, each 2 ft. × 1 ft., are required to turf a lawn 36 yards long and 20 yards wide? How much will the turfs cost at 10/- per hundred?

(4) How many flagstones, each 4 ft. square, are required to pave a courtyard whose length is 42 yards and breadth 24 yards?

(5) How many planks, each 15 feet long and 9 inches wide, are required for a platform 30 feet long and 12 feet wide?

(6) Find the cost of painting on both sides, 6 doors, each measuring 8 ft. by $3\frac{1}{2}$ ft., at the rate of $\frac{1}{2}d.$ per square foot.

(7) What will it cost to cover a garden path, 36 yards long and 6 feet wide, with gravel at 1/3 per square yard?

(8) There are 4 windows, each containing 6 panes. If each pane measures 2 ft. by 1 ft. 6 ins., find the total cost of glass for the four windows at 6*d.* per square foot.

EXAMPLES 30 (d).

(1) Copy the sketch (Fig. 13), putting in the measurements as shown. Find the area of—

(*a*) The whole rectangle ABCD.
(*b*) The small rectangle EFGH.
(*c*) The border between the two rectangles.

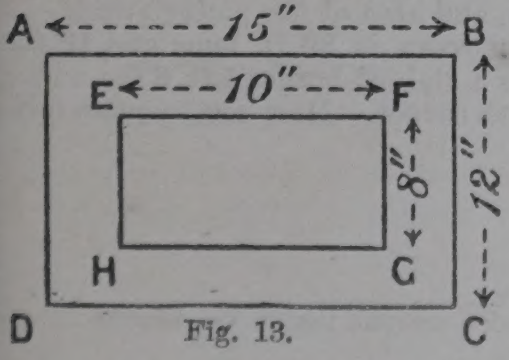

Fig. 13.

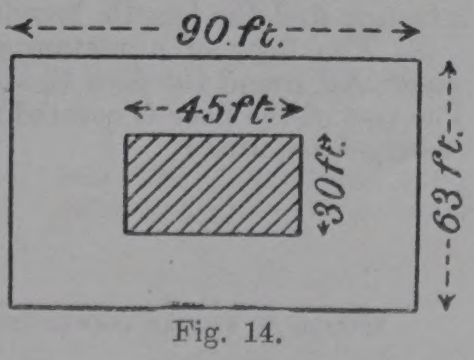

Fig. 14.

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(2) DATE rden which co a flower plot with a grass border. Find—

(*a*) The area of the whole garden.
(*b*) The area of the flower plot.
(*c*) The area of the grass border.

(3) The length of a room is 25 feet, and its breadth 18 feet. The middle portion of the floor is covered with a carpet 20 feet long and 15 feet wide, and the rest of the floor is stained. What is the area of the stained portion?

(4) A photograph is mounted on a sheet of cardboard. The cardboard itself measures 17 ins. by 14 ins., and the photograph measures $10\frac{1}{2}$ ins. by 8 ins. Find the area of the border.

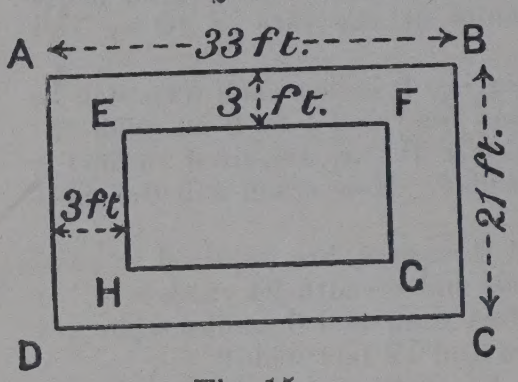

Fig. 15.

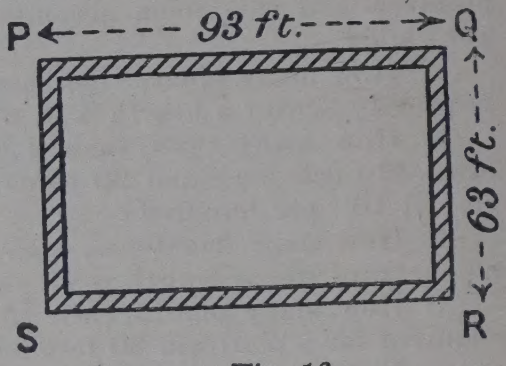

Fig. 16.

(5) Copy the sketch (Fig. 15), putting in the measurements as shown. Find—

(*a*) The length of **EF**.
(*b*) The length of **FG**.
(*c*) The area of the whole rectangle **ABCD**.
(*d*) The area of the small rectangle **EFGH**.
(*e*) The area of the border between the two rectangles.

(6) Fig. 16 is the plan of a garden, with a path going all round it. The width of the path is 4 ft. Find the area of the part actually used as garden (the inside rectangle) and the area of the path.

(7) The length of a framed picture is 27 inches, and its breadth 21 inches, outside measurement. If the width of the frame is 2 inches, find the length, breadth, and area of the picture itself.

(8) The floor of a rectangular room is 25 ft. long and 18 ft. wide. All round the floor there is a stained border 1 ft. 6 ins. wide. The rest of the floor is covered with carpet. How many square feet of carpet are used?

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TABLES, ETC.

LENGTH.		AREA.	
12 inches	= 1 foot.	144 sq. inches	= 1 sq. foot.
3 feet	= 1 yard.	9 sq. feet	= 1 sq. yard.
22 yards		[illegible] yards	= 1 sq. chain.
10 chains			
8 furlongs			
100 links			
$*5\frac{1}{2}$ yards			
4 poles			
40 poles			
1 chain			
1 mile			

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